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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

Agenda Item : D.14

Israel

DEVELOPMENT OF BUILDING TECHNIQUES IN ISRAEL

By A. ALWEYL,
Director,
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Ministry of Housing, Israel

Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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DEVELOPMENT OF BUILDING TECHNIQUES IN ISRAEL

by A. Alweyl, Director, Engineering Department,
Ministry of Housing, Israel

1. Scope of Building Activities.

Since the establishment of the State in 1948, the population of the country has increased from 750,000 to 2,200,000 as a result of mass immigration and natural growth. In order to meet the housing needs created by such a rapid growth, 437,000 dwelling units have been erected during this period, of which 57,000 are temporary in character, while 380,000 are permanent housing. Out of the total of permanent housing, some 127,000 dwelling units have been built by private enterprise, whereas the remaining 310,000 either directly by the Government, or through Government sponsored housing schemes.

Concurrently, this activity of housing construction has been accompanied by the erection of public buildings and a considerable number of industrial structures in the existing towns as well as in the new towns which have been built since the establishment of the State in various regions of the country.

In 1961, total investment in building activities of all kinds amounted to IL 651,600,000 of which IL 391,400,000 in housing and IL 260,200,000 in other branches of building (industrial, farm, public and commercial buildings). These investments accounted for about 30% of overall investment in the national economy in that year. Building, then, constitutes one of the most important factors in the economy.

2. Methods used in Israel's Housing Schemes.

The problems involved in the planning and execution of the country's housing schemes have been far from simple. First of all, there was the need for rapid execution in order to cope with the urgent housing needs of the rapidly growing immigration and that, within the scope of a limited budget. Furthermore, in the early period of the State's existence, mass immigration which doubled the population in the space of three years coincided with an acute shortage of both skilled labour and building materials. In order to obtain maximum output, several building schemes had to be carried out simultaneously, while plans had to be adapted to specific conditions in the various regions of the country. However, the experience gained in the execution of large-scale housing schemes made it possible to examine and compare the various systems, from the point of view of efficiency and economy.

Prevailing conditions were most difficult when the State's first housing schemes were being put into effect. The situation improved however during the second stage of the country's housing project construction, when a marked rise occured in the quality of the structures.

During the initial stage (1949-1953), three main methods were used:

1. Building with hollow concrete blocks.
2. Concrete casting in standard form.
3. Various light types of structures.

The blocks were usually prepared on the site, and their quality was not always in accordance with the stahdard requirements. This fact, combined with the shortage of skilled labour, led to the development of the second method - concrete casting of walls in standard moulds. By introducing various technical innovations into the processes of mould construction and casting, this method did effect a marked saving of skilled labour. The standard forms were made of wood or plywood, the concrete was "ordinary" or "no fine".

Urgent housing needs for incoming immigrants, necessitating hasty execution, also led to the erection of temporary wooden structures, although technical considerations as well as the high percentage of imported materials involved, clearly demonstrated the disadvantages of this method. Some of these structures were assembled locally, while others were imported as complete units. Their walls were lined on the outside with wooden boards, covered inside by hard-boards, the roofs being covered by concrete tiles or asbestos.

The situation has considerably changed during the second stage of housing operations (1953-1962). Now it became possible to select constructions methods more carefully, with a view to their technical implications as well as to economic considerations. Thus, the use of methods which required large quantities of imported materials was restricted to a minimum. The percentage of wooden structures dropped noticeably. The use of cast concrete walls which had been formally prevalent all over Israel, became restricted to a few areas. These measures led to a considerable saving in imported building materials - particularly in wood and iron.

Hollow concrete blocks - the quality of which was improved, as factory-made pressurised blocks replaced the former practice of primitive casting on the site - became the most important element in construction. With the development of the local building materials industry, silicate and ytong blocks were introduced. In mountainous areas, some housing projects were built of rubble stone.

3. Economic Comparison of Walls built of Various Materials.

The diagram in Fig.1 gives an economic comparison between walls constructed under various systems. The cost of walls per m^2 is given in relation to the concrete hollow-block wall as a base unit (base cost = 100). It includes the cost of concrete lintels with the required reinforcement, as well as the expenditure on plastering, where this is necessary according to the system. The diagram also shows the respective percentages of expenditure on labour on site, as well as for local and imported materials, for the various types of walls.

As the diagram shows, the cost per m^2 is lowest in the wall built of hollow concrete blocks. This explains the widespread use of this type of wall in housing projects in comparison to other systems. Thus, brick masonry walls are not constructed in public housing projects, as a result of their cost being considerably higher than the cost of concrete hollow-block walls. Similarly, the relatively high cost of rubble stone walls, which were common use in certain regions (e.g. the Jerusalem region), owing to architectural considerations, has resulted in their replacement by walls constructed of prefabricated elements with different coverings, e.g. exposed aggregate, etc.

4. The Development of Systems using Prefabricated Elements.

During the last years considerable progress has been achieved in the use of precast reinforced concrete units in the construction of new housing. This method offers the advantages of rapid execution, a saving in the quantities of materials owing to

the use of higher-quality materials, as well as a reduction in the amount of skilled laboured required and economy in the use of imported materials.

The Housing Division directed its efforts, in the first place, to the introduction of all these components through the use of which, savings in foreign currency expenditure are attained. These included floors and roofs, which under more conventional systems of building required substantial amounts of wood and steel. Furthermore, the Division encouraged the development of various methods of producing prefabricated concrete trusses; notable achievements were attained in this direction. Thus, the use of wooden trusses has been almost wholly discontinued in public housing projects, where reinforced precast trusses are currently used in their place.

5. Prefabricated Systems using Medium and Large Elements.

At the present moment, three local plants are engaged in the manufacture of prefabricated building elements e.g. walls, floors of medium size. In addition, a system using large elements, in the form of cell units (cubes) of ceilings and walls has been introduced since last year.

One plant, situated at Eilat, is manufacturing 300 - 500 dwelling units per annum. The structure used under this system is composed of prefabricated elements of medium size, for floors and walls; the walls are constructed of two layers of prefabricated plates, with an air-space in between. The plates are 80 cm. in width and approximately 2.50 m. in height. Another plant, at Shderot, manufactures about 500 dwelling units per annum. The elements produced are 2.00 m x 2.50 m. in size. Floors and walls are of hollow structure with round cavities. The "Rastrum" factory, situated at Holon, manufactures about 300 dwelling units a year. The elements of the building are 1.00 m. x 2.50 m. in size and they are cast according to the "sandwich system", with a layer of light concrete alternating between two concrete layers. In Jerusalem, the erection of a first series of about 100 dwellings according to a system developed by the contractor Mr. Diskin, is nearing completion. Under this system, the elements are prepared in the form of cells of reinforced concrete cast in situ, and assembled with the aid of cranes.

6. The Contribution of Research to Development of Building Methods.

Activities in the field of building research undertaken by the Building Research Station, Israel Institute of Technology, and other institutions (the Productivity Institute, the Israeli Standard Institute, Soil Mechanics Laboratory, and the Technion's Structural Division) have considerably contributed to the development of Israel's building methods. Thanks to these research activities, important improvements have been introduced in conventional building methods, on the one hand, while at the same time the development of new building methods has largely benefited from the results of research work. The following examples may be quoted:

a. Flat Plate Floors.

The Division of Structural Engineering, Israel Institute of Technology, headed by Prof. D. Yitzhaki, has carried out a study on reinforced concrete flat plate floors(*)
This research has contributed to the solution of certain problems of resistance to punching for this type of roofs and floors. Shear reinforcement was found to be highly effective in preventing punching failure; thus it was de-

* Experimental Investigation of Flat Plate Floors, by Israel Rosenthal. Journal of the American Concrete Institute, August 1959.

monstrated that thin,resistant slabs can be designed,with the use of round-bar reinforcement. The results of the study have made possible a wider application of this method in housing schemes,resulting in an appreciable economy in construction costs, as well as a higher speed of execution.

b. Poststressed Concrete Hollow-Block Walls.

Another study covering problems of poststressed walls, has contributed to the development of a method aimed at strengthening buildings constructed of hollow concrete blocks and built on heavy clay. According to this method, steel wire ties of ultimate strength 17,000 kg/cm2 are used as a means ofor preventing cracking. The method is also suitable for repairing cracked buildings,and is cheaper than other methods practiced hitherto.

c. Precast Reinforced Concrete Roof Trusses for Public Housing Schemes*

As mentioned in Chapter 4, extensive development of prefabricated building methods has taken place in Israel with the active encouragement of the Ministry of Housing.

The above research has contributed to this development by determining the most suitable methods in production of R.C.trusses from the technical and economic points of view. The main conclusions arrived at were as follows: 1) "Closed" Trusses(i.e. with a horizontal tie-bar)have certain advantages over structures with separate anchor bars. 2) From the viewpoint of resistance to corrosion,all-concrete structures are preferable. 3) The avarage safety factor of the assembled structure,related to the ultimate load was 3.5 . 4)The R.C.precast is 9% cheaper than the wooden one. 5) Foreign currency expenditure is 40% lower for the precast structure.

d. Cost Research.

Research work on building costs in Israel has contributed considerably towards a better evaluation of efficient systems,thereby achieving reductions in building costs. As an example, we shall quote the results of a research project** which was carried out last year, on the subject of rational structure of light industry buildings. Suwh buildings,destined for light industry and workshops, have been constructed in Israel in various systems. From the point of view of wall material - either built of concrete hollow blocks, built between columns, either cast in situ or prefabricated, or concrete walls comprising precast concrete plates assembled between precast concrete columns. From the point of view of roof construction too, various systems are practiced,those in common use being the following roofs of corrugated asbestos sheets on either steel or precast concrete elements, r.c. hyperboloid-paraboloid structures etc.

As demonstrated by the diagram in Fig.2, this research has established the advantage of prefabricated structures, in comparison with other types of structures, from the point of view of expenditure in both local and foreign currency.Further, the economy in building costs is higher in proportion to the percentage of precast concrete elements in the structure.

Among structures with concrete roofs, there are certain advantages to hyperboloid - paraboloid shell structures, from the point of view of very low percentages of expenditure on steel and forms. It is assumed that by wider use of this

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* Research Paper No.5 by A.Alweyl, J.Fichman, J.Karni. Building Research Station, Technion, Israel Institute of Technology,Haifa 1957.

** A.Alweyl, J/Sokal, Study on Structural Systems of Industrial Structures, Building Research Station, June 1962.

system, which is characterized by simpler shuttering, in comparison with that of the cylindrical shell, lower building costs may be obtained.

7. Topical Building Problems and New Fields of Development.

The improvements hitherto registered in building methods currently employed in Israel, will undoubtedly serve as a basis for further progress in the development of technically and economically sound methods.

Two main tendencies are clearly visible in this development: 1) The introduction of methods enabling savings in skilled labour as well as increasing the speed of execution. 2) Fuller exploitation of local raw materials in the building materials industry.

The problem of manpower shortage in the country's building activity constitutes one of the main motives in the drive towards new building methods. In 1961, the scope of building activity was 33% larger than that of 1959, whereas the number of workers employed increased by a mere 7%. As in other countries with a growing industry, workers are attracted by jobs in industrial plants, where conditions are considerably more comfortable than those prevailing in out-of-doors construction jobs. Several proposals have been made with a view to solve this problem, such as: intensifying activities of professional training, grants and higher wages to building workers, etc. Albeit, among builders, the conviction that conventional building methods should be at least partially replaced by new ways of construction, if the current problems are to be solved, steadily gains ground.

Two main approaches are discernable: a) one approach is based on the concept of prefabrication of big building elements in factories, and their assembly on situ. b) a second approach favours the introduction of more efficient methods of execution on situ by means of improved organizatuonal methods of work, as well as by a higher rate of utilization of equipment and various mechanical tools.

As is well known in many countries - and in European countries in particular - opinions vary concerning the best approach to be taken; in Israel, current tendencies favour the application of both attitudes simultaneously.

As has been previously stated, several small plants in Israel are enployed in the manufacture of small or medium prefabricated elements, which have met with a certain amount of success, and are improving from year to year. Furthermore, it is proposed to build in the country, several plants for the manufacture of larger elements (room-size), similar to those existing in certain west European countries. According to this proposal, 3 to 4 such plants will be erected, in order that the overall production of prefabricated elements will attain 4,000 - 5,000 dwelling units per year, i.e about 15% of the total number of dwellings in public housing construction. Currently, the whole matter is under consideration, mainly from its technical and economical points of view.

It is assumed that the erection of these plants will considerably ease the pressure of manpower shortage in construction works; still it is clear that other means too, will be required in order to solve the problems which currently confront us. It is beyond dispute, though, that we have to do our utmost in order to encourage the utilization of mechanical equipment, which should be, however, rationally integrated with the work organization and the various sites.

The following types of work are most suitable for more intensified and wider use of equipment: a) production of concrete on site, b) vertical and horizontal transportation on the building site, c) standard forms and scaffolding, d) cutting and bending of iron rods.

In the production of concrete on situ, a certain improvement has already been attained, as central production stations are gradually replacing production at the side of individual buildings. This system of concrete production, though, has to be further developed to the maximum possible extent. Mechanical scrapers.too have already proved their advantage, by eliminating the most strenuous work of loading aggregates onto transportation vehicles and into the feeder element. By further increasing the use of these scrapers, a large reduction in expenditure on concrete production will be possible.

Among items of equipment which have been put into use on numerous building sites in the country, mention should be particularly made of the cranes. Both experience and research work which has been carried out in Israel, have proved that high rates of efficiency may be attained through the use of this equipment, on condition that the work is properly organized, and that due consideration is given to other factors which influence the profitability of its use. On the other hand, the high amount of investment capital required for equipment of this sort necessitates considerable care regarding the method of its operation, lest it should turn into a mere burden, where efficient work organization is lacking.

Following the considerable success with which moulds and scaffolding manufactured as standard equipment by workshops have met, there is a tendency to expand their use. It has been proved, that through the use of such standard forms and scaffolding, a lot of work is saved in assembly and dismounting, especially regarding skilled labour; also the same equipment may be used over and over for many times.

The profitability of operating electrical equipment sets in the cutting and bending of steel rods, is dependent to a large amount on the quantity of reinforcement concentrated on each individual site, as well as on the scope of the yearly production. On this subject, too, a research work has been carried out, enabling an evaluation to be made in each individual case.

After having outlined the main tendencies prevailing in building industrialization and mechanization, it may be added that mutual interrelation exists between the improvement attained in mechanical vertical transportation equipment and the development witnessed in the use of prefabricated elements. The existing tendency to achieve an economic utilization of such equipment results in a greater degree of adaptability among contractors concerning the use of prefabricated elements. Thus, at the present moment, there exists higher probability that the use of prefabricated elements of all kinds will attain considerable proprtions with the near future. In particular, the following developments are likely to materialize: a) increased use of prefabricated floors of pre-stressed concrete, b) the use of reinforced Ytong elements for walls, partitions, roofs and ceilings, c) production of gypsum elements for ceilings and partitions. In each of these fields, a considerable improvement has been recently witnessed; it is to be hoped that the manufacturing plants will shortly attain regular production.

In the future stages of development in the country's building methods, an important role will beplayed by the activities of building research, which has already proved its vital integrity as one of the main factors in the drive towards the improvement of existing building methods and the development of new methods.

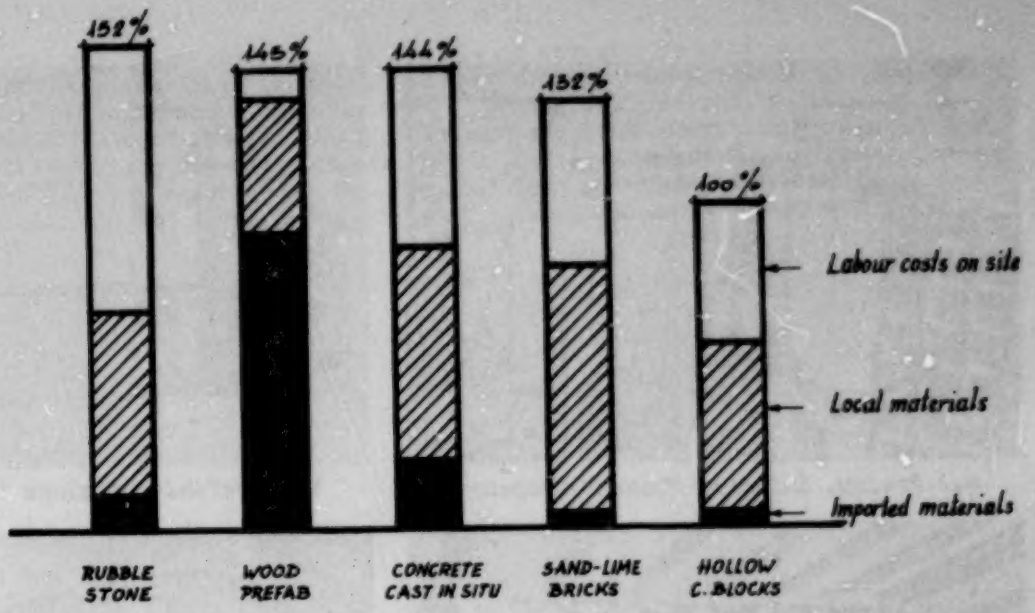


Fig. 1 : Comparison of costs per sq.m. between various wall construction systems.

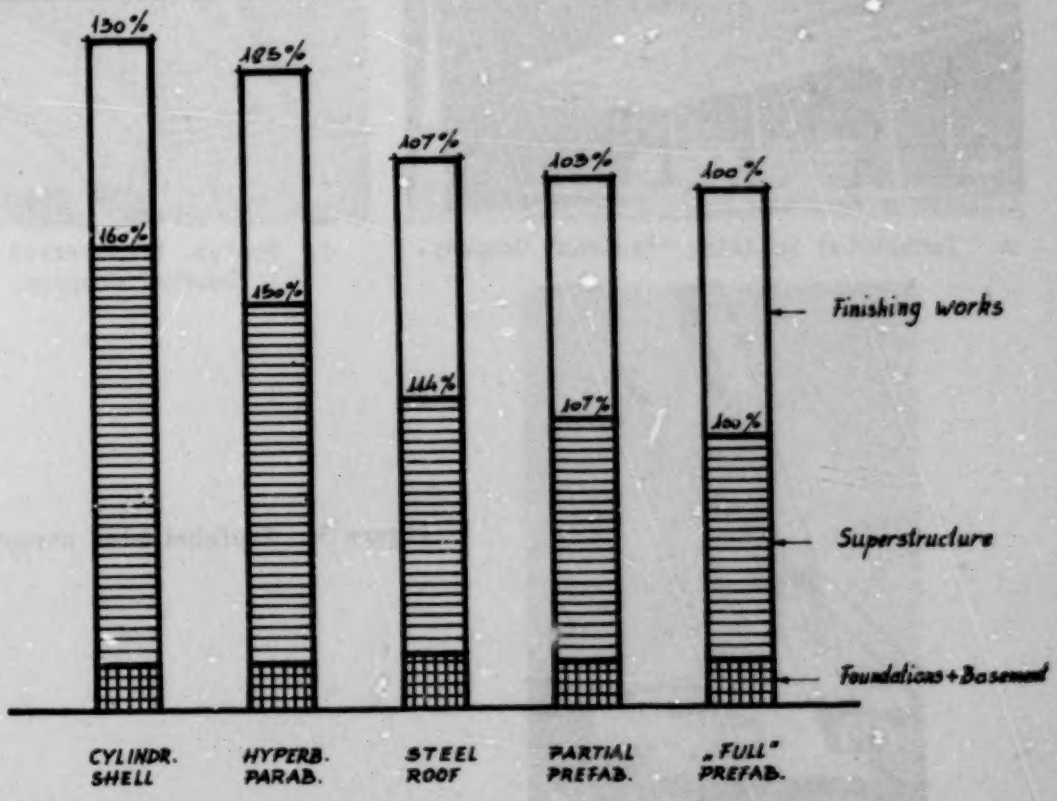
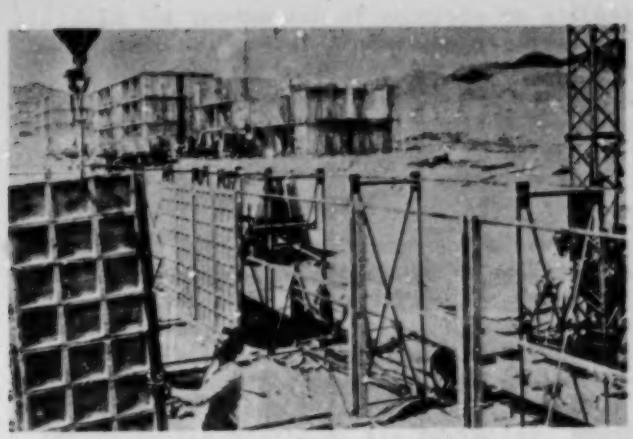
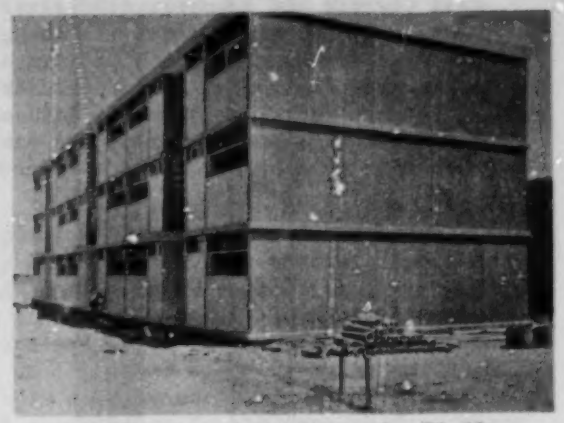


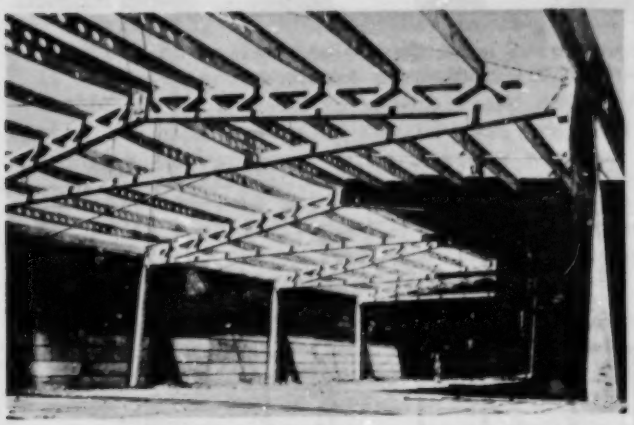
Fig. 2 : Comparison of costs per sq.m. between various systems of industrial buildings construction.



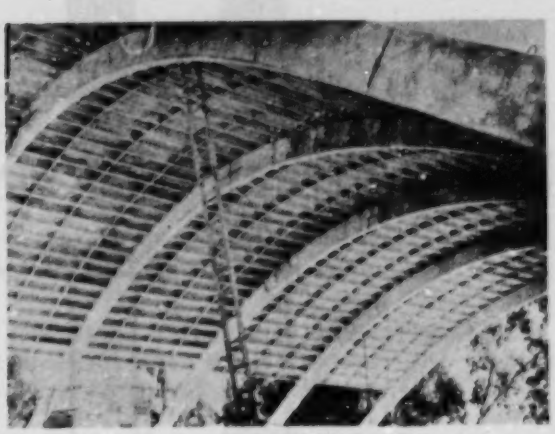
a. Prefab. Building "Mabat" Company.



b. Prefab. Buildings in Elath.



c. Industrial Building "Rastrum" Company.



d. Prefab. Prestressed Structure "Rasrum" Company.

e. The "Diskin" System.

Figure 3. Prefabricated structures

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SUMMARY
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ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
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SUMMARY

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DEVELOPMENT OF BUILDING TECHNIQUES IN ISRAEL

by

A. ALWEYL, Director, Engineering Department,
Ministry of Housing, Israel.

SUMMARY

Since the establishment of the State in 1948, the population of the country has increased from 750,000 to about 2,200,000 as a result of mass immigration and natural growth. In order to meet housing needs, about 437,000 dwelling units have been erected during this period. Investments in building in the recent years accounted for about 30% of overall investment in the national economy.

The problems involved in the planning and execution of housing schemes were far from simple. There was the need for rapid construction in order to meet the urgent housing needs of the new immigrants and that within the scope of a limited budget. There were periods, when the shortage of building materials and skilled labour was keenly felt. In order to attain the maximum output, several building systems had to be used simultaneously.

The following main methods were in use: 1. Building with hollow concrete blocks, 2. concrete casting in standard forms, 3. various light type structures. In the mountain areas rubble stone was used to some extent for construction of walls. From the economic point of view, building with factory made hollow concrete pressurised blocks has proved its advantages.

During the last few years considerable progress has been made in the use of precast reinforced concrete elements in the construction of new housing. This method offers the advantages of rapid execution, a reduction in the amount of skilled labour required and saving in the quantity of imported materials (steel, wood).

At the present time three local plants are also engaged in the production of medium size R.C. elements and their assembling on building sites. A new system using elements in the form of prefabricated reinforced concrete cells has been introduced last year.

Two main trends are clearly visible in the development of building systems in Israel:

1. The introduction of methods enabling savings in skilled labour as well as increasing the speed of construction.
2. Fuller exploitation of local raw materials in the building materials industry.

The main approaches to solution of the problem of skilled labour shortage and required speed of construction are:

a. Prefabrication of large elements in factories.
b. Introduction of more efficient methods of execution in situ by means of improved site organization and the use of mechanical equipment.

The use of mechanical equipment has already proved its advantages in the following types of work: central concrete production on large building sites, vertical and horizontal transportation, cutting and bending of steel reinforcement rods.

The following new developments are expected in the near future:

a. Increased use of prefabricated prestressed concrete elements.
b. The use of reinforced Ytong elements.
c. Increased use of gypsum elements for ceilings and partitions.
d. Establishing of two plants for the production of R.C. room-size elements.

Building research has already proved its vital integrity as one of the main factors in the drive towards the improvement of existing building methods and there is no doubt, that it will play an important role in the development of new methods.

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CONFÉRENCE DES NATIONS UNIES
SUR L'APPLICATION DE LA SCIENCE ET DE LA TECHNIQUE
DANS L'INTÉRÊT DES RÉGIONS PEU DÉVELOPPÉES

Point de l'ordre du jour : D.11

Brésil

EMPLOI DE LA VINASSE DANS L'AGRICULTURE

Par Urgel DE ALMEIDA LIMA,
de l'Instituto Zimotécnico
de l'Université de Sao Paulo

Les mémoires rédigés à l'intention de la Conférence des Nations Unies sur l'application de la science et de la technique dans l'intérêt des régions peu développées sont des documents de travail. Ils sont publiés tels qu'ils ont été présentés et les assertions et opinions qu'ils contiennent sont celles de leurs auteurs.

NOTES

1. Les mémoires choisis pour être présentés en séance générale pourront être obtenus à la Conférence dans les langues officielles suivantes des Nations Unies: anglais, espagnol, français et russe.

2. Les mémoires choisis pour être présentés en séance spéciale pourront être obtenus à la Conférence dans l'une seulement de ces langues officielles.

3. Les résumés qui ont été rédigés pour tous les mémoires par les auteurs de ceux-ci pourront être obtenus à la Conférence dans les langues officielles suivantes des Nations Unies: anglais, espagnol, français et russe.

4. Préalablement à la Conférence, les mémoires et les résumés ne feront pas l'objet d'une distribution générale mais d'un tirage restreint destiné aux délégations des gouvernements et autres participants officiels. La publication et la distribution générale des actes de la Conférence s'effectueront conformément aux règles et pratiques agréées par le Comité des publications des Nations Unies.

EMPLOI DE LA VINASSE DANS L'AGRICULTURE

par Urgel de Almeida, LIMA
de l'Instituto Zimotécnico de
l'Université de São Paulo

La vinasse est le plus important des résidus de l'industrie d'alcool et des eaux-de-vie au Brésil. Grossièrement son volume peut être calculé comme 10 fois le volume d'alcool ou d'eaux-de-vie produits par une distillerie.

Après la deuxième guerre mondiale le développement de l'industrie sucrière et des alcools au Brésil fut vertigineux, notamment dans l'Etat de São Paulo. En conséquence devient grave le problème d'écoulement des résidus, surtout de la vinasse, le plus profondément nuisible.

Ses effets se firent sentir d'autant plus affectant les caractéristiques physiques et chimiques des cours d'eau, l'ichtyologie, la santé publique et se présentant comme un pivot important de troubles sociaux qui ont dégénéré presque en des révolutions populaires de conséquences imprévisibles.

Les systèmes de récupération élaborés jusqu'au moment n'étaient pas satisfaisants du point de vue économique. Tout de même, quelques procédés préconisés pour les égouts d'autres compositions n'étaient pas suffisantsdu point de vue technique.

Depuis 1922 le problème d'écoulement des vinasses fut étudié par plusieurs techniciens de sucrerie et par des investigateurs, envisageant l'utilisation des solides totaux comme engrais. Tous les procédés furent abandonnés car ils étaient anti-économiques, même ceux qui préconisaient son usage comme fertilisant, neutralisé et floculé avec hydroxide d'aluminium. Pendant des dizaines d'années le problème défia la science sans avoir réussi à des résultats pratiques. Pendant l'année de 1949, des investigateurs constituant la première équipe de l'Institut Zymotechnique sont arrivés à des conclusions qui permirent d'élaborer les techniques pour profiter de toute la vinasse comme engrais, dans des applications <u>in natura</u> avec des résultats dépassant les prévisions.

1. LA VINASSE ET LA POLLUTION DES COURS D'EAU

C'est le plus nuisible des résidus instables, parce qu'elle possède une action réductrice extrêmement haute qui exige une teneur très élevée d'oxygène pour se stabiliser. Elle résiste à n'importe quel traitement connu pour des effluents industriels et c'est un des plus acides et plus corrosifs. Au-delà de cette propriété il est le plus volumineux. Comme on disait plus haut on calcule la production de la vinasse comme dix fois plus la production d'alcool et d'eaux-de-vie. Dans l'Etat de São Paulo, elle comprend la plus grande surface polluée dans des concentrations dangereuses et souvent funestes. La production de distillats alcooliques à São Paulo est calculée environ 300 millions de litres et celle de la vinasse, en 3 billions de litres. Pour une campagne de 5 mois, cela se traduit par 232 litres par sec.

Le pouvoir de pollution de la vinasse est calculé comme 20.000 p.p.m. Cela signifie qu'il faut 4,640 millions de litres par seconde d'eau pure pour stabiliser le résidu.

En faisant une comparaison entre la vinasse et les égoûts des villes auxquels on admet 200 litres par jour et per capita, avec un B.O.D., de 300 p.p.m., on constate que le pouvoir de la vinasse est 66 fois plus grand. Par conséquence on peut supporter un effluent maximum de 3 litres par jour et per capita. Le volume des effluents totaux de São Paulo s'équivaut à une population de 6,7 millions d'habitants. Ce qui rend le problème plus grave, vient du fait que la vinasse était jetée aux fleuves et rivières dans des zones concentrée et en doses supérieures à 100 fois plus qu'il n'est permis.

Des observations faites une fois par semaine pendant 70 semaines au cours des années de 1953 et 1954, nous révélèrent que la région hydrographique du fleuve Piracicaba était un vrai égout ouvert, sans aucune possibilité de récupération naturelle. L'unique façon d'éviter la pollution était d'empêcher les écoulements de vinasse. Cela fut atteint et la pollution fut réduite considérablement.

A ce temps là, le volume du fleuve Piracicaba varia de 49 à 200 m3/sec. étant donné que l'écoulement minimum coïncida avec les versements maximums. Les valeurs de B.O.D. montèrent à des niveaux supérieurs à 400 p.p.m.. Dans deux semaines, n'ont pas pu être déterminées les valeurs de B.O.D., même avec des dilutions à 1 et à 0,1% de l'eau du fleuve dans de l'eau distillée oxygénée.

Le tableau I donne la correspondance entre l'écoulement du fleuve et la hauteur limnimétrique. Les figures I et II illustrent l'intensité de la pollution. Le graphique I fut construit avec les valeurs hebdomadaires et le graphique II avec les moyennes mensuelles.

2. LA VINASSE ET L'ICHTYOLOGIE

Les poissons affluent avec intensité aux endroits où tombe la vinasse, à cause de la matière organique qu'elle contient et qui leur sert d'aliment. Le pouvoir toxique agit sur les poissons au moment même qu'il atteint les régions où la dégradation est active à son maximum. Au fur et à mesure qu'on avance sur cette zone de dégradation les effets nuisibles se font sentir sur le plancton et sur les grands animaux aquatiques. A cause de l'action réductrice la vinasse consomme l'oxygène dissous et par son acidité très élevée, change trop le pH. Cela tue les poissons larvophages produisant un déséquilibre biologique, élimine la microflore et la microfaune et met en garde la faune maritime qui cherche les côtes.

3. LA VINASSE ET LA SANTE PUBLIQUE

Comme l'oxygène dissous n'est pas suffisant pour stabiliser la matière organique contenue par la vinasse, une fermentation anaérobique et putride se déclare avec émission de mauvaises odeurs et des gaz toxiques. L'eau devient impropre à l'alimentation et aux fins d'amusements. Les microorganismes et les moustiques y trouvent un milieu très favorable. Les maladies intestinales, le paludisme et d'autres maladies sont facilement transmises, souvent en caractère d'épidémies.

4. LA VINASSE ET LA SOCIOLOGIE

Les populations privées de l'eau pure et menacées par toutes mauvaises conséquences de la pollution se révoltent contre les industriels qui à leur tour nient leur participation dans la pollution et ne font rien pour l'éviter.

Dans les régions où la pollution se montra concentrée avec les quotients astronomiques, pendant les années de 1953 et 1954, la presse et la population exigèrent des pouvoirs publics une répression sévèrent contre les distillateurs. A ce temp-là, on avait déjà une solution économique pour le problème. Si les industries n'avaient pas compris leur responsabilité la foule aurait fait justice de ses mains avec des conséquences imprévisibles.

5. COMPOSITION DE LA VINASSE

La composition de la vinasse est très variable et se trouve en étroite dépendance de la composition des vins soumis à la distillation. Comme ils varient selon la matière première, le système de préparation des moûts, la fermentation alcoolique, le type d'appareil de distilllation, etc., on ne peut pas présenter des chiffres qui présentent la composition moyenne générale de tous les types de vinasses.

Tout de même, on peut considérer la vinasse comme constituée de 89 à 94% d'eau et de 6 à 11% de solides totaux. Ceux-ci contiennent de 4 à 8% de matière organique, presque toute colloïdale.

La matière minérale en proportion de 1 à 2,6% comprend plusieurs éléments, dont la potasse est le prédominant avec 9 à 13 g/litre. Ensuite, viennent le calcium (2,0 à 4,0 g), l'azote (1,0 à 3,5 g), la magnésie (0,8 à 1,5 g) et le phosphore (0,4 à 2,0 g).

6. ACTION DE LA VINASSE SUR LE SOL

a) Le pH de la vinasse varie entre les limites de 3,7 à 5,9 mais contribue à l'alcalinisation du sol et cette action se vérifie avec la vinasse pure ou neutralisée avec du lait de chaux.

b) La vinasse augmente le pouvoir d'imbibition du sol pour l'eau et l'augmentation est plus grande pour les vinasses acides que pour les vinasses neutralisées.

c) La vinasse améliore les propriétés physiques et chimiques du sol.

d) Contribue à une plus grande rétention des sels minéraux.

e) Augmente extraordinairement la microflore du sol.

f) Elimine l'érosion.

g) Donne à la canne à sucre des conditions pour un meilleur cycle de végétation et favorise le développement des racines, qui profitent mieux du cube de terre.

h) Change la végétation expontanée, donnant lieu aux végétaux caractéristiques des terres fertiles.

7. APPLICATION DE LA VINASSE COMME FERTILISANT

Après la constatation de l'action de restauration de la vinasse sur les sols, on préconisa son emploi comme fertilisant. Sa valeur comme engrais fut vérifiée pour le riz, le maïs, le coton, les haricots et la canne à sucre.

Les études furent réalisées en échelle de laboratoires, en étuves et dans des conditions agricoles. Le plus grand essai eut lieu sur un terrain de 40 hectares et avec une irrigation réalisée dans les conditions de la grande pratique agricole.

On conseille l'application de vinasse seulement pour la canne à sucre parce que la canne est la culture plus importante pour les distillateurs d'autant plus que la quantité de ce résidu est insuffisant même pour la canne.

Quand on fait l'application de la vinasse comme engrais, on doit le faire avec le liquide encore chaud et sans aucun traitement, tel qu'il sort des appareils de distillation. Cette façon de conduire les travaux est nécessaire pour éviter des dépenses qui sont justement le point négatif de tous les procédés étudiés, jusqu'au système préconisé par l'Institut Zymotechnique de l'Université de São Paulo.

L'irrigation avec la vinasse dans cette condition trouve des obstacles qu'on peut surpasser, cela parce que les résultats de la fertilisation sont encore économiques, même avec des grandes dépenses.

a) Volume de vinasse à appliquer
C'est le premier obstacle à vaincre. La production de vinasse d'une fabrique étant environ dix fois plus grande que la production de distillat signifie une énorme quantité de liquide à transporter, par journée de travail. Cela est facile à résoudre, car les quantités préconisées à cause des expériences de fertilisation varient de 600.000 à 1.000.000 de litres par hectare.

b) Transport de la vinasse
C'est le deuxième obstacle à l'application de la vinasse. Elle est comme des plus corrosifs résidus industriels. Les matériaux résistants sont chers et il faut chercher des artifices pour distribuer la vinasse sans de grandes dépenses.

Le transport peut être fait par quatre systèmes basiques : par des camions-citernes, par des tuyauteries sous pression, par chute naturelle et dans les eaux ordinaires d'irrigation. Chaque système a ses adeptes et se conditionne à la situation topographique de chaque industrie.

c) Préparation du terrain
C'est le troisième obstacle à vaincre. Les distillateurs en général accusent la fertilisation avec vinasse de les obliger à des préparations trop coûteuses du sol dans une époque peu favorable aux travaux de la campagne : excès de travaux de la récolte, sol très sec et manque de main d'oeuvre. Cela n'a pas raison d'être et peut se réaliser avant le commencement des travaux de distillerie, cela surtout parce que on a besoin de récupérer un engrais si riche.

L'application de la vinasse selon les prescriptions de l'Institut Zymotechnique obéit à deux schémas : application aux terrains de canne de première plantation et aux terrains où existe déjà la canne plantée depuis un an ou plus.

8. APPLICATION POUR LES TERRAINS A ETRE PLANTES

a) Avant de commencer les distillations dans une période qui varie selon les possibilités et la production de la distillerie, on procède à la préparation du terrain, labourant, hersant et sillonnant en courbes de niveau, une surface suffisante pour la vignasse qu'on produira pendant toute la campagne. Les sillons sont faits à une distance de 1,50 m et à une profondeur de 20 à 30 cm.

b) La distribution de la vinasse est faite sur le terrain convenablement préparé, in natura, chaude, sans dilution et directement sur les sillons, ouverts pour recevoir la canne à planter.

c) La quantité obéit aux conditions du sol. Ceux qui possèdent un pH inférieur à 4 reçoivent 1.000.000 de litres par hectare ou 100 litres par mètre linéaire. Les terres avec un pH compris entre 4 et 5 sont irriguées avec 850.000 litres ou 95 litres par mètre linéaire. Aux sols de pH supérieur à 5 on distribue 650.000 litres ou 70 litres par mètre linéaire de sillon.

d) Pour les industries qui veulent faire l'irrigation par aspersion les quantités sont le double de celles recommandées pour chacun des cas précédents, cela parce que la distribution sera faite au-dedans et hors des sillons.

e) L'application du volume total de vinasse sur les sillons de la surface préparée en avance, sera faite pendant toute la période de la campagne, de façon continue ou intermittente selon le système de transport adopté par l'industrie.

f) Le terrain qui reçut la vinasse comme il est préconisé recevra une nouvelle application, seulement quand toutes les autres divisions de la ferme auront subi le même traitement.

g) La plantation peut être réalisée une semaine après la fin de l'irrigation avec vinasse si on veut planter les cannes d'une année, soit celles qu'on plante du mois d'octobre à décembre. Pour les cannes d'une année et demie, soit celle qu'on plante de janvier à avril on doit maintenir le terrain libre des herbes qui auront poussé dans cette période d'attente.

h) Les dépenses avec les travaux complémentaires sont largement payées par l'amélioration du rendement de la production de cannes qui sera 3 à 10 fois plus grande dans les aires irriguées.

i) La durée d'une application de vinasse est de 4 ans en moyenne selon la nature du sol. Après 4 ans on détruit la canne et on laisse en repos pendant une année l'aire du terrain en y plantant une légumineuse.

j) Après ce repos, on laboure la terre en incorporant toute la masse d'engrais vert et on prépare pour une nouvelle plantation comme il fut déjà écrit.

k) Si le terrain est de nature faible, on y ajoute des engrais chimiques pour compléter la fertilisation organique.

l) En procédant comme il fut décrit, il n'y aura pas le danger d'émission de mauvaises odeurs pendant l'application de la vinasse car toute la quantité s'infiltrera rapidement, sans danger de fermentation pùtride et ses inconvénients.

9. APPLICATION DE LA VINASSE DANS LES TERRAINS DEJA PLANTES DE CANNE

L'application de la vinasse sur les terrains déjà plantés avec canne à sucre suit le même schéma précédent pour la première plantation, avec des soins spéciaux pour ce système d'engraissage.

a) Après la récolte on entasse ou on brûle les feuilles et ensuite on fait un sillon, pas trop profond, entre les rangs de canne plantée.

b) Sur les sillons on applique la vinasse comme s'il s'agissait dans le cas précédent de canne à planter.

c) La quantité suivra la même règle déjà exposée. S'il s'agit d'irrigation par aspersion, on conseille de rincer les feuilles de la canne avec de l'eau propre, après l'application de vinasse, au moins pendant 5 minutes.

d) L'application du volume total sera faite sur les sillons de façon continue ou intermittente, après la première, la deuxième ou la troisième coupe de la canne, selon les intérêts de la distillerie. L'irrigation des champs déjà plantés peut commencer après la récolte et continuer jusqu'au huitième mois après le bourgeonnement.

e) L'application de la vinasse se fait avec soin sur les cannes germinées pour qu'elle ne brûle pas les feuilles existentes.

f) Après la 4ème coupe on détruit la canne, on laisse en repos le terrain comme il est recommandé précédemment.

10. AIRE TOTALE D'APPLICATION DE LA VINASSE

A titre d'exemple, supposons une distillerie qui produit 100.000 litres de distillat alcoolique par jour, travaillant 150 jours pendant une campagne.

D'après un calcul grossier, la production de la vinasse dans la campagne sera de :

$$100.000 \times 10 \times 150 = 150.000.000 \text{ litres}$$

Obéissant à la distribution de vinasse selon le pH des sols, on pourra irriguer de 145 à 242 hectares, ce qui est très peu pour une distillerie de cette grandeur.

Si on limite l'application de la vinasse à un cercle de 3 km de rayon, la surface disponible pour recevoir la vinasse serait de :

$$S = 3,1416 \times 3000^2 = 28.274.400 \text{ m}^2$$

$$S = 2,827 \text{ hectares}$$

Comme la quantité de vinasse appliquée par an varie de 145 à 242 hectares, un champ recevra une nouvelle irrigation après :

$$2.827 + 242 = 12 \text{ ans à peu près}$$
$$2.827 + 145 = 20 \text{ ans à peu près}$$

Cette façon de conduire la fertilisation en employant la vinasse ne pourra jamais porter le sol à la stérilisation, ni empêcher la canne d'atteindre sa maturation, même que la période de végétation soit un peu plus longue, car il n'y a pas d'excès de matière organique.

11. CONSEQUENCES DE L'EMPLOI DE LA VINASSE EN AGRICULTURE

a) La vinasse est un engrais de grande valeur par sa richesse en matière organique et minérale, capable de faire monter le pH du sol à des valeurs d'alcalinité. La vinasse augmente la population microbienne des terrains traités, augmente le pouvoir d'imbibition pour l'eau, améliore la rétention des sels minéraux, élimine l'érosion, modifie la végétation typique et favorise le cycle de végétation de la canne à sucre. Elle provoque un délai dans la maturation de la canne mais augmente sa richesse en saccharose et la pureté du jus.

b) Fait disparaître les mauvaises influences sur les cours d'eau, le plancton des fleuves et des rivières se rétablit et l'eau reprend les bonnes caractéristiques organoleptiques.

c) Rétablit l'équilibre biologique des cours d'eau et les poissons repeuplent les eaux courantes, favorisant aussi nos réserves ichtyologiques.

d) La récupération de la vinasse et l'élimination de son écoulement sur les cours d'eau créent des conditions sanitaires avec des réflexes directs sur le peuple, éliminant les maladies transmises par les moustiques ou par voie microbienne.

e) Améliore les conditions hygiéniques et on observe avec cela une stabilisation sociologique avec le retour des conditions pour la vie au long des rivières et l'usage des fleuves pour des fins d'amusement et le retour de l'aspect esthétique du paysage, préjudicié par les effets nuisibles de la pollution.

f) Sur le champ de l'économie, la récupération de la vinasse se fait sentir directement sur l'économie de devises en réduisant l'importation des engrais, surtout les potassiques et augmente la production.

12. RESULTATS OBTENUS AVEC L'APPLICATION DE LA VINASSE SUR LA CANNE

L'augmentation de production relative par surface varie avec la nature du terrain. En chiffres ronds l'augmentation fut de 3 à 10 fois plus que celle des témoins non irrigués.

L'application sur des champs déjà plantés avec la canne rendit possible la récupération de cannes de mauvaises productions, quelquefois avec des rendements meilleurs dans les 4ème et 5ème coupes que la première fois.

Les observations furent réalisées sur divers types de sol et avec quelques variétés de canne à sucre poussant chez nous.

Ainsi :

La variété CB-36/24 cultivée dans sol faible, sableux, acide et sans complément d'autres engrais, produisit comme moyenne de 6 coupes :

Avec vinasse	-	117 tonnes par hectare
Témoin	-	25,5 tonnes par hectare

Les maximum obtenus à la 1ère coupe furent :

Avec vinasse	-	283,4 tonnes par hectare
Témoin	-	71,7 tonnes par hectare

La variété Co-421 sur le même sol produisit comme moyenne de 5 couples :

Avec vinasse	-	119,0 tonnes par hectare
		45,9 tonnes par hectare

Maximum à la première coupe

Avec vinasse	-	171,9 tonnes par hectare
Témoin	-	66,0 tonnes par hectare

La variété Co-419 sur le même sol précédent produisit comme moyenne de 5 coupes :

Avec vinasse	-	151,5 tonnes par hectare
Témoin	-	13,4 tonnes par hectare

Maximum à la première coupe

Avec vinasse	-	248,6 tonnes par hectare
Témoin	-	85,8

La variété Co-421 sur sol acide, épuisé, rouge, produisit comme moyenne de 7 coupes, 99,7 tonnes par hectare.

La variété CP-27/139 sur sol pauvre, acide, rouge, produisit comme moyenne de 4 coupes :

Avec vinasse	-	62,5 tonnes par hectare
Témoin	-	10,7 tonnes par hectare

La variété Co-290 sur le même sol, produisit comme moyenne de 4 coupes :

Avec vinasse	-	65,1 tonnes par hectare
Témoin	-	42,3 tonnes par hectare

La variété CP-27/139 sur sol fertile, argileux, peu acide produisit comme moyenne de 2 coupes :

Avec vinasse	-	167,9 tonnes par hectare
Témoin	-	137,9 tonnes par hectare

La variété Co-290 sur sol boueux, argileux, fertile, peu acide, produisit comme moyenne de 5 coupes :

Avec vinasse	-	118,5 tonnes par hectare
Témoin	-	80,4 tonnes par hectare

La variété POJ-2878 sur sol silice-argileux, fertile, peu acide, produisit comme moyenne de 5 coupes :

Avec vinasse	-	66,9 tonnes par hectare
Témoin	-	45,2 tonnes par hectare

Les résultats obtenus dans l'Etat de São Paulo furent toujours positifs en apportant dans tous les cas, des bénéfices économiques pour les distillateurs.

13. RESULTATS D'APPLICATION DE LA VINASSE SUR D'AUTRES CULTURES

Des haricots cultivés sur terrain sableux, acide, très faible, produisirent :

Avec vinasse	-	15,53 sacs de 60 kg ou 931,8 kg/hectare
Témoin	-	0,55 sacs de 60 kg ou 33,0 kg/hectare

Une deuxième plantation sur le même endroit, produisit :

Avec vinasse	-	33,8 sacs de 60 kg ou 2.030 kg/hectare
Témoin	-	1,46 sacs de 60 kg ou 87,6 kg/hectare

Du coton cultivé sur le même type de sol précédent, produisit :

Avec vinasse	-	1.462,5 kg/hectare
Témoin	-	331,5 hg/hectare

Du maïs cultivé sur le même sol précédent, produisit :

Avec vinasse	-	50,88 sacs de 60 kg ou 3.052,8 kg
Témoin	-	14,35 sacs de 60 kg ou 861,0 kg

Des irrigations avec vinasse furent essayées dans d'autres cultures et sur des fleurs et des plantes horticoles, avec des résultats très bons, mais qu'on n'enregistra pas, parce qu'il n'y avait pas d'intérêt économique, comme pour la canne à sucre, capable elle-même d'absorber toute la quantité de ce résidu de son industrialisation.

14. ESSAIS DE CORROSION REALISES AVEC LA VINASSE SUR DES TUYAUX

Les essais de corrosion réalisés sur des tuyaux furent le premier soin, quand on pensa distribuer la vinasse sous pression dans les appareils d'irrigation. La corrosion est due à l'acidité très élevée de ce résidu de la distillation des vins.

Les premiers essais furent réalisés avec des segments de tuyaux de différents diamètres et avec des pièces employées dans les tuyauteries comme les T, les unions, les courbes et les coudes.

Les segments furent plongés dans les caisses de vinasse à la sortie des appareils de distillation et y restèrent 52 jours. Pendant la durée des observations les pièces furent lavées, séchées et pesées 7 fois.

Les résultats sont résumés comme il suit :

Tuyaux en acier inoxydable	0,00%	de corrosion
en cuivre	0,32%	
en laiton	0,82%	
en duraluminium	1,51%	
en plomb	4,65%	
en fer (tubes pour chaudières)	11,37%	
en fer galvanisé	13,70%	
Joints en fer galvanisé	14,99%	de corrosion
Courbes en fer galvanisé	18,58%	
T en fer galvanisé	20,37%	

Les calculs furent basés sur la perte de poids par 100 kg du matériel essayé.

A côté des observations sur la corrosion des tuyaux métalliques on essaya aussi les tuyaux en grès, pour vérifier la résistance à la corrosion et la possibilité de les employer dans la distribution de la vinasse. Les tuyaux en grès ont une faible résistance dans les joints de ciment, dont la corrosion est très intense. Ce type de tuyauterie peut être recommandé pour le transport de vinasse en chute naturelle.

Les tubes en P.V.C. furent essayés avec une installation-pilote pour le transport de la vinasse sous pression, montée à l'Institut Zymotechnique. Ils se montrèrent parfaitement viables pour le transport de la vinasse, à condition que la température du résidu ne dépasse pas 60°C. Aux conditions d'essai, les tuyaux en P.V.C. résistèrent très bien, avec 0,00% de corrosion.

La température n'est pas un obstacle sérieux pour l'emploi du P.V.C. parce qu'on peut baisser la chaleur de la vinasse en mélangeant des eaux résiduaires, de lavage, de réfrigération et même les eaux ordinaires d'irrigation.

15. D'AUTRES APPLICATIONS POUR LA VINASSE

En outre que la fertilisation, la vinasse constitue un milieu de culture pour le développement de levures comestibles, spéciales, employées dans la préparation de protéïne de bonne qualité.

En même temps qu'on prépare la protéïne en employant la vinasse comme milieu de culture, on arrive à réduire jusqu'à moitié le pouvoir de pollution des effluents, car on consomme beaucoup de composants de la vinasse pendant la fermentation levurienne.

La vinasse est aussi un bon substratum pour faire pousser les champignons comestibles.

On pense actuellement utiliser la vinasse dans la cuisson de quelques farines comme la farine de soja pour améliorer la saveur et les propriétés alimentaires.

De tous les usages trouvés pour la vinasse, nous croyons que, dans notre pays, l'unique solution parfaite pour le problème est celle de la fertilisation parce qu'on la dépense sans difficulté et tout entièrement.

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ANNEXES

TABLEAU I

Hauteur limnimétrique en cm	Écoulement du fleuve en l/sec	Hauteur limnimétrique en cm	Écoulement du fleuve en l/sec
25	49.100	65	90.200
30	53.700	90	122.000
35	58.500	130	175.000
50	73.500	150	202.000

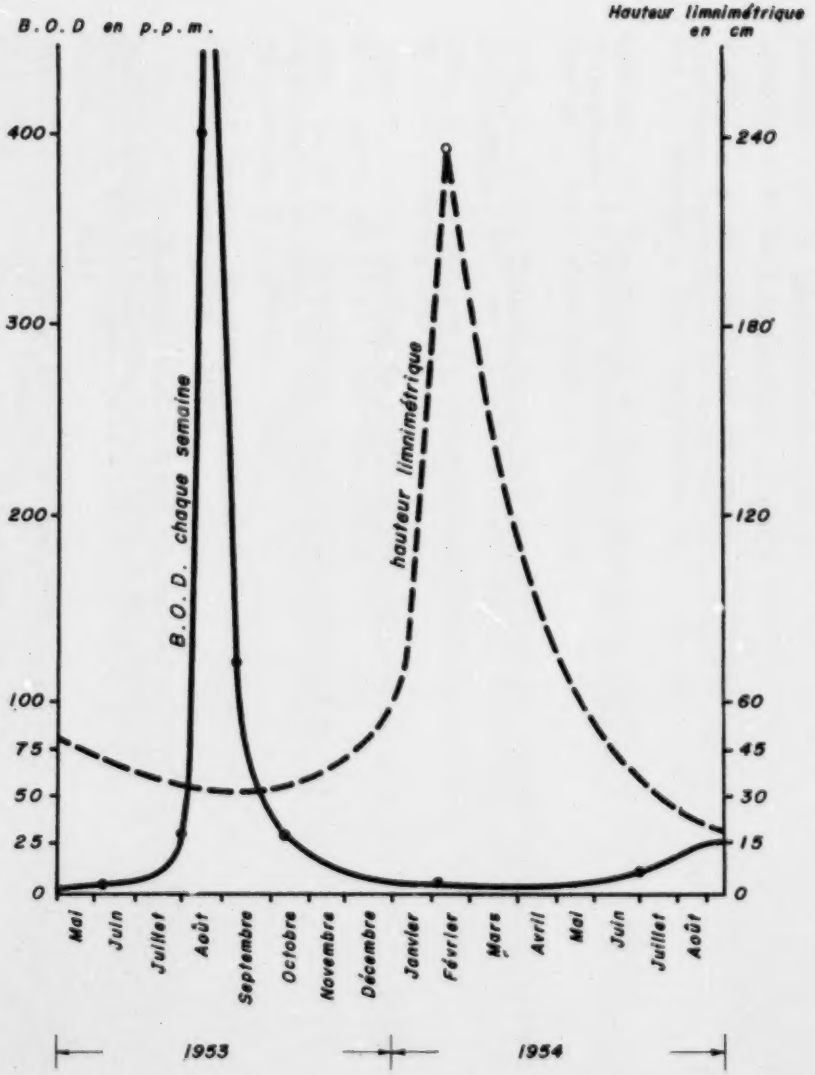

Figure I

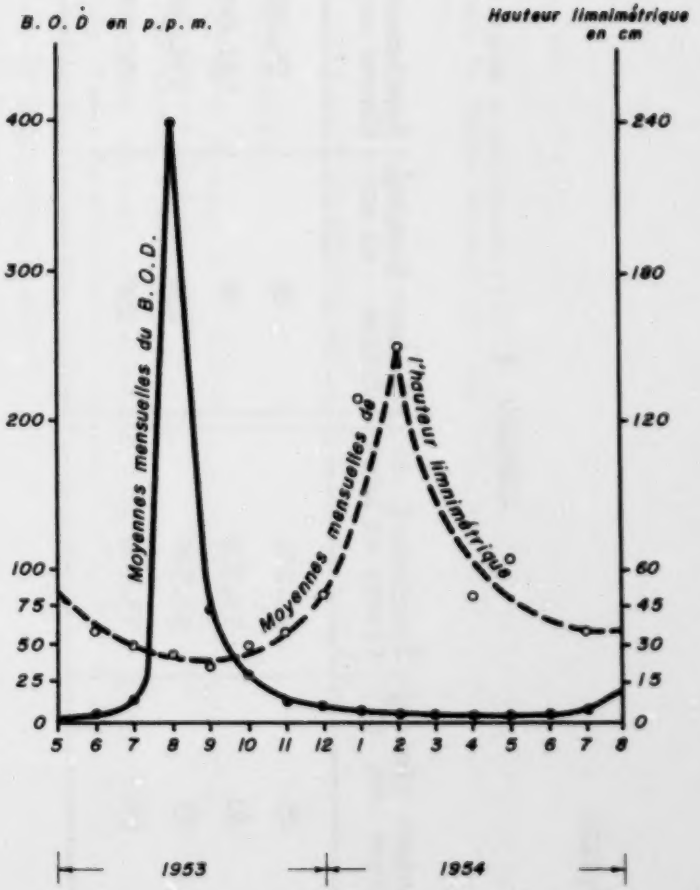

Figure II

Figure III - Essai avec canne de la variété CB-36/24 avec vinasse et sans vinasse aux six mois

Figure IV - Essai d'irrigation par vinasse en chute naturelle

718 F - Nov. 1962 - 1,000

UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
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SUMMARY

Agenda Item : D.11

Brazil

THE USE OF VINASSE IN AGRICULTURE

By Urgel de Almeida LIMA,
of the Institute of Fermentation
Technology, Sao Paulo University

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THE USE OF VINASSE IN AGRICULTURE

By
Urgel de Almeida Lima of the
Institute of Fermentation
Technology, Sao Paulo University.

Vinasse is the most important residual product of the alcohol and spirits industry of Brazil. Though it abounds in organic colloidal substances and mineral elements, vinasse produces deleterious results if introduced into streams or rivers, as was the custom in Brazil until some years ago. This was done simply because it was impossible to dispose of vinasse in any other way, owing to the lack of an economically worthwhile process of recuperation. Consequently, vinasse constituted a serious danger to public health, to the economy, and to the fish population, besides giving rise to popular unrest in a number of regions in Brazil where the degree of pollution reached truly astronomical proportions. From the economic point of view, filtration, decanting, oxygenation and evaporation methods for the recuperation of vinasse in solid form are either completely ineffective or else too expensive.

Having analysed the composition of vinasse and made a good many tests in the laboratory, in drying-rooms and on an agricultural scale, a research team of the Institute of Fermentation Technology and their assistants succeeded in finding the solution to this problem. This is to use vinasse as a fertiliser, without any treatment, but hot, as it comes pouring out from the distilling machinery, and at once. This new process was tried out in the soil conditions of the State of Sao Paulo, and proved to be not only rational and economic but also capable of absorbing the entire supply of vinasse from any distillery.

Vinasse is spread on ground previously ploughed, harrowed, and furrowed in contour-lines over an area large enough to absorb the full amount required from a campaign. The furrows should be spaced 1.5 metres apart, and cut to a depth of 20 to 30 centimetres.

The vinasse is drained off in its natural state - i.e. hot, undiluted, and without being neutralised.

The amount to be used varies according to soil conditions. Where the pH of the soil is less than 4, the amount should be 1,000,000 litres, or 100 litres per metre length of furrow. Where the pH is between 4 and 5, the amount should be 850,000 litres, or 95 litres per linear metre, But where the pH is higher than 5, irrigation should be limited to 650,000 litres, or 70 litres per linear metre of furrow.

The application of the entire supply of vinasse available to the furrows of the land previously prepared should be carried on throughout the duration of the campaign, either continuously or at intervals, according to the system of transport adopted by the industry.

Any area on which vinasse has been used, as suggested above, is not to be irrigated again until all the other sections of the farm have been similarly treated.

If the methods described above are properly applied, there will be no danger of offensive smells during treatment with vinasse, for the entire quantity seeps rapidly into the ground, with no risk of putrefactive fermentation and its disadvantages.

Because it is rich in organic and mineral substances, vinasse ranks as a highly valuable fertiliser capable of raising the pH of the soil to alkaline values. Vinasse increases the microbe population in the land to which it has been applied to an incredible degree; it increases the water absorbing capacity; it improves the retention of mineral salts; it eliminates erosion; it modifies the typical vegetation and promotes the growth cycle of sugar-cane. While it causes some delay in the ripening of sugar-cane, vinasse improves its sucrose content and the purity of the juice.

The detrimental influences on streams and waterways disappear; plankton in streams and rivers is restored, and so are the positive organoleptic properties of the water.

The biological equilibrium of the waterways is likewise restored, while the fish population returns to streams and rivers, thus contributing to Brazil's reserves of fish.

The recuperation of vinasse, and the fact that it is now no longer discharged into streams and rivers, has led to an improvement in the general standard of health with corresponding benefits to the population, who are now free from diseases formerly transmitted by mosquitoes and microbes.

Higher health standards have in turn led to stability on the social plane, thanks to the return of normal living conditions along the waterways.

Recuperation of vinasse has, moreover, a direct bearing on the saving of foreign currency by reducing the need for imports of fertilisers, in particular those containing potash, and by increasing agricultural production a factor between 3 and 10, as compared with non-irrigated land.

Vinasse can be distributed by tanker-trucks by gravity descent, by mixing with irrigation water, and by using pressurised pipe-lines.

Tests made to ascertain the amount of corrosion caused by vinasse in pipes have shown that pipes made of stainless steel or of polyvinyl chloride (PVC) are most resistant to corrosion. Next on the list are copper, brass, duralumin, lead, and iron - in order of strength.

Besides being an extremely powerful fertiliser for sugar-cane and other crops, vinasse is also a good culture medium for the development of special yeasts and for mushrooms, for the preparation of high-grade protein for both human and animal consumption.

Plans are currently under consideration for vinasse to be included in animal foods, in order to improve the digestive qualities and flavour of certain types of flour.

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CONFÉRENCE DES NATIONS UNIES
SUR L'APPLICATION DE LA SCIENCE ET DE LA TECHNIQUE
DANS L'INTÉRÊT DES RÉGIONS PEU DÉVELOPPÉES

Point de l'ordre du jour : D.14

Italie

SYSTEMES ET METHODES DE PREFABRICATION APPLIQUES INDUSTRIELLEMENT EN ITALIE ET POSSIBILITES DE DEVELOPPEMENT DANS L'INTERET DES PAYS QUI ONT UNE ECONOMIE PEU DEVELOPPEE

Par M. Ezio ERCOLI,
Secrétaire Technique de l'Association
Italienne de la Préfabrication

Les mémoires rédigés à l'intention de la Conférence des Nations Unies sur l'application de la science et de la technique dans l'intérêt des régions peu développées sont des documents de travail. Ils sont publiés tels qu'ils ont été présentés et les assertions et opinions qu'ils contiennent sont celles de leurs auteurs.

NOTES

1. Les mémoires choisis pour être présentés en séance générale pourront être obtenus à la Conférence dans les langues officielles suivantes des Nations Unies: anglais, espagnol, français et russe.

2. Les mémoires choisis pour être présentés en séance spéciale pourront être obtenus à la Conférence dans l'une seulement de ces langues officielles.

3. Les résumés qui ont été rédigés pour tous les mémoires par les auteurs de ceux-ci pourront être obtenus à la Conférence dans les langues officielles suivantes des Nations Unies: anglais, espagnol, français et russe.

4. Préalablement à la Conférence, les mémoires et les résumés ne feront pas l'objet d'une distribution générale mais d'un tirage restreint destiné aux délégations des gouvernements et autres participants officiels. La publication et la distribution générale des actes de la Conférence s'effectueront conformément aux règles et pratiques agréées par le Comité des publications des Nations Unies.

SYSTEMES ET METHODES DE PREFABRICATION APPLIQUES INDUSTRIELLEMENT EN ITALIE ET POSSIBILITES DE DEVELOPPEMENT DANS L'INTERET DES PAYS QUI ONT UNE ECONOMIE PEU DEVELOPPEE

par M. Ezio Ercoli, Secrétaire Technique de l'Association Italienne de la Préfabrication.

PREMISSE

1 a Nous désirons commencer d'abord par quelques définitions, pour passer ensuite à développer notre argument.

I 1) Lorsque nous disons "Pays peu développés", nous entendons par là tous ces pays qui sont autour de l'équateur et particulièrement ceux qui sont compris, à peu près, parmi le 20ème parallèle nord et le 20ème parallèle sud.

I a Nous avons omis volontairement dans nos considérations tous ces pays que l'on appelle d'ordinaire "peu développés" et qui ne sont pas compris dans la bande susdite, car l'on peut faire, pour la région choisie, des observations tout-à-fait particulières par rapport aux possibilités de la préfabrication.

II 2) Pour préfabrication nous entendons "fabrication industrielle en Usine" des différentes parties des oeuvres de génie civil, pouvant être employée sur place avec des opérations comportant principalement des assemblages.

b Naturellement, dans ce bref mémoire, nous ne pouvons qu'effleurer certains problèmes et certaines possibilités offertes par la préfabrication.

CHAPITRE 1er

2 - Caractéristiques locales et leurs réflexes sur le développement de la construction, par rapport à lapréfabrication.

a En étudiant la possibilité pratique d'appliquer la préfabrication dans les Pays tropicaux peu développés, il ne faut pas oublier les nombreux facteurs pouvant influencer positivement ou négativement le choix parmi les différents systèmes de préfabrication utilisables convenablement dans les Pays que l'on est en train d'examiner.

b Certaines caractéristiques du milieu et surtout :

I a) le bas prix des terrains affectés à la construction,

II b) certaines tendances particulières, qui portent à une individualisation remarquable,

III c) la possibilité de simplifier au plus haut degré le type des bâtiments,

IV d) l'occupation de la population, surtout agricole,

nous portent à préférer les bâtiments monofamiliers, monoplans.

c Tout cela est surtout vrai en rapport aux maisons proprement dites, mais il l'est aussi en rapport aux édifices publics et surtout aux constructions scolaires.

d Pour le moment, nous ne nous occuperons pas des écoles supérieures, des Universites, etc. et nous examinerons en particulier les écoles primaires, élémentaires et secondaires.

e Nous voyons tout de suite que la dispersion remarquable de la population sur des régions très étendues nous porte à préférer un type de construction scolaire formée de petites constructions éparses : ce sont là des caractéristiques semblables, du point de vue technologique, à celles des maisons monfamilières.

f On peut déduire par là que le type de préfabrication préférable dans ces pays est celui appelé en Italie "fornitura chiavi in mano", c'est-à-dire ces types de constructions standard livrées complètement achevées par les industries, qui ne se bornent donc pas à fournir des éléments que l'on doit ensuite assembler avec des pièces fournies par d'autres industries.

g Ces constructions peuvent être assemblées sur place, même par des équipes d'ouvriers non specialisés ou, du moins, pas hautement spécialisés, sous la direction d'un chef monteur.

h De plus, ces constructions peuvent être déduites d'un projet standard, réalisé avec une série de matériaux fournis par une seule industrie.

i Les problèmes architectoniques et technologiques de cette méthode sont moins importants que ceux qui sont liés aux systèmes de construction industrialisés, dans lesquels chaque élément est fourni par des Maisons différentes.

Chapitre 2ème

3 - Problèmes technologiques.

3 a On doit examiner maintenant en détail certains problèmes technologiques, qui sont posés :

I a) par le climat,

II b) par la faune locale (possibilité d'attaque par des insectes),

III c) par la qualité des matériaux, par rapport aux exigences de la population.

b Le problème de l'isolement thermique dans les conditions tout-à-fait particulières de température et d'humidité de ces régions est bien plus sérieux et complexe que le même problème dans un climat tempéré.

c Pour les constructions des pays tropicaux, on demande des taux d'isolement plus élevés que pour les constructions standard des pays hautement industrialisés, dans lesquels et pour lesquels ces types de bâtiment ont été projetés.

d En outre, le problème de la résistance à la faune locale a une plus grande importance: c'est pourquoi certains matériaux utilisables convenablement dans les climats tempérés ne sont pas du tout à conseiller pour les climats tropicaux.

e Nous nous référons en particulier à certains matériaux isolants de type fibreux, non minéral, et à certains matériaux à base de bois et fibre de bois, qui sont plus facilement attaquables par des insectes et par d'autres petits animaux à sang chaud vivant dans ces climats.

f La préfabrication au contraire peut employer des matériaux plus résistants aux conditions du milieu, soit à celles climatologiques, soit à celles dues à la faune locale: parmi ces matériaux, nous mentionnons les produits à base de fibro-ciment, acier, aluminium, les matières plastiques et, avec certaines réserves pour le poids, le béton et les briques.

g Il faut aussi souligner, lorsqu'il s'agit de pays qui ont un bas niveau économique, la nécessité d'une grande facilité d'entretien, car la durabilité des constructions a là plus d'importance que dans les milieux qui ont un niveau économique élevé.

h D'où la nécessité de projeter des bâtiments dont les finissages extérieurs et intérieurs soient particulièrement forts et se détériorent difficilement, soit par des causes intérieures, soit extérieures accidentelles.

i On doit parler maintenant d'un autre important paramètre et précisément du poids.

l Nous ne toucherons point aux difficultés de transport dans le cas d'importation : nous nous bornerons à souligner qu'on trouve aussi maintes difficultés à transporter les matériaux du lieu de centralisation au lieu de construction.

m Souvent, le manque de routes, ou même le mauvais état des routes existantes causent une majoration remarquable de frais : dans ce cas, la préfabrication présente des avantages évidents auprès des systèmes de construction traditionnels, car l'incidence du transport des matériaux bruts (béton, briques, etc) surpasse parfois et rend illusoire leur avantage économique par rapport aux plus chers matériaux utilisés dans la préfabrication.

n En plus, le manque souvent remarquable d'outillage de chantier et la nécessité qui en découle de procéder à l'assemblage avec des outillages improvisés, ou même à la main, nous fait conclure que les systèmes de préfabrication légère sont avantagés par rapport aux systèmes de préfabrication lourde.

Chapitre 3ème

4 - Considérations économiques.

a Aujourd'hui, dans les pays peu développés, dans les circonstances économiques actuelles, on ne se borne pas à favoriser l'importation des constructions des pays plus industrialisés, mais l'on cherche à monter sur place des industries nationales, qui, utilisant les matières premières du pays et, pour autant que possible, la main d'oeuvre locale, produisent les éléments nécessaires aux besoins nationaux.

b Au premier abord, une économie de ce type peut nous paraître nettement favorable aux économies locales : en réalité, elle ne doit être poursuivie qu'après des examens attentifs des matières premières locales et des possibilités d'absorption du marché local et des marchés voisins.

c Les matières premières locales sont constituées, en général, par du bois, des terres, des argiles et, parfois, par du béton et du plâtre : l'on trouve rarement des matériaux de prix, tels que des demi-façonnés d'acier, d'aluminium, ou des matières plastiques et du verre.

d D'où la nécessité de sélectionner les systèmes de préfabrication qui peuvent être utilisés, parmi ceux qui consentent un plus large emploi des matières premières locales : il faut toutefois considérer que ces systèmes doivent être intégrés avec l'importation de demi-façonnés de prix, qu'on ne peut pas trouver sur place.

CONCLUSION

5 a Nos considérations doivent servir à orienter les opérateurs locaux et les personnes responsables des économies des Nations nouvelles, récemment créées dans les zones peu développées, dans le choix et la sélection des systèmes et des méthodes d'industrialisation de la construction qui, en Italie, ont déjà été mis au point et qui peuvent être pris en considération pour une diffusion éventuelle, dans l'intérêt de ces régions.

b Une plus large description de ces systèmes se trouve dans un volume publié par l'Association Italienne de la Préfabrication, que nous joignons à ce mémoire.

c Ce volume est composé de fiches techniques rigoureusement homogènes, soit quant à la forme de l'exposition que quant au contenu et décrit les différents matériaux et les nouveaux systèmes de construction existant aujourd'hui sur le marché italien.

d Les caractéristiques techniques respectives peuvent être déduites par un examen détaillé du volume, dont un certain nombre d'exemplaires est à la disposition des intéressés, auprès de l'Association Italienne de la préfabrication, qui a rédigé cette note.

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SUMMARY

Agenda Item : D.14

Italy

SYSTEMS AND METHODS OF PREFABRICATION APPLIED INDUSTRIALLY IN ITALY, AND THE POSSIBILITY OF DEVELOPMENT IN THE INTERESTS OF THOSE COUNTRIES WHICH HAVE A LITTLE DEVELOPED ECONOMY

By Ezio ERCOLI,
Technical Secretary
to the Italian Prefabrication
Association

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SYSTEMS AND METHODS OF PREFABRICATION APPLIED INDUSTRIALLY IN ITALY, AND THE POSSIBILTY OF DEVELOPMENT IN THE INTERESTS OF THOSE COUNTRIES WHICH HAVE A LITTLE DEVELOPPED ECONOMY.

By
EZIO ERCOLI, TECHNICAL SECRETARY
TO THE ITALIAN PREFABRICATION
ASSOCIATION.

SUMMARY

INTRODUCTORY PART

The possibilities of prefabrication systems in the interest of municipal development in the less developped areas, particularly in the Middle-East and African regions, are briefly examined.

DESCRIPTIVE PART

The different Italian systems which may be utilized in this sector are here described within the framework of the industrial structure of the sector in Italy, and of its actual and future productive possibilities and capacities.

A detailed description is given of the types of unit made in Italy, together with the respective technical characteristics.

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Agenda Item: D.2.2

Romania

PROBLEMS OF STRUCTURE AND TERRITORIAL DISTRIBUTION OF INDUSTRY

By Prof. Constantin IONESCU,
Candidate in Economic Sciences

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PROBLEMS OF STRUCTURE AND TERRITORIAL DISTRIBUTION OF INDUSTRY

Prof. Constantin Ionescu,
Candidate in economic sciences

1. The proportional development of the national economy requires the establishment of some just proportions between various branches of industry, as well as the establishment of corresponding proportions in the complex development of all regions, by a rational distribution of the forces of production all over the territory of our country. The proportions reported to territory ensure one of the fundamental equilibriums which condition the general economic development. For this very reason, within a planned economy - where the problem has best conditions of settlement - the carrying out of some just proportions reported to territory represents one of the main objectives of the policy of industrialization. At the same time, one must have in view that there is a mutual interdependence between the two groups of proportions - proportions on the national economy and proportions reported to territory; that is why we consider that some problems of territorial distribution of industry can be analysed only in accordance with some proportions of the economy which determines them.

2. Thus in Rumania, in order to create an adequate structure of industry, the ensurance of certain proportions was consistently pursued, the most important of which are the following:

a) The proportion between the production of the branches producing means of production and the production of the branches producing consumer goods.

i) The achievement of correct proportions between these groups of branches was obtained by the priority growth of the production of the means of production as against the increase of the production of consumer goods. The priority development of the branches producing means of production and first of all the heavy industry and its pivot, the machine-building industry, has ensured the country's industrialization, the introduction of technical progress all over our economy, the consistent achievement of the process of large-scale reproduction, the raising and improvement of production, the superior turning to good account of the national wealth and the permanent increase in the people's living standard.

ii) Following this line in ensuring a just proportion between the two groups of branches, Rumania has developed the industry producing means of production at a more rapid rate that the production of consumer goods. This explains the fact that, while the production of the means of production increased in 1961 by nearly 7.8 times, compared with 1938, the

production of consumer goods increased over 4 times.

iii)The production of the machine-building and metal processing branch, the central pivot of the heavy industry, was in 1961 13 times bigger than in 1938.

iv) The priority increase of the heavy industry brought about the improvement of the proportions between the two groups of production .

v) The evolution of the structure of overall production on groups of production, is as follows:

- in % -

Groups of production	1938	1948	1950	1961
a. The production of the means of production	45.5	49.4	53.0	60.9
b. The production of consumer goods	54.5	50.6	47.0	39.1

vi) The plan of developing the economy of the Rumanian People's Republic for the years 1960 - 1965 provides for the further priority increase of the output means of production, which will ensure a 2.2 times growth of the output of the means of production by 1965, as compared with 1959 and the growth by about twice of the production of the consumer goods industry.

b) The proportion between the branches of the extraction industry and the branches of the processing industry. The establishment of some adequate proportions between these groups of branches ensures in addition to the continuous development of production , a rhythmic activity in the utilization of the production capacities and of the labour force.

c) The proportion between the output of electric power and the production of other branches of industry. Economic experience shows that the development of the production of electric power must go ahead the other branches of industry in order to be able to satisfy the electric requirements of the other branches and to ensure the continuous introduction of new technique in production by electrification, mechanization and automation of the processes of production.

i) As compared with 1938, in 1961 the output of electric and thermic power was 12 times bigger, an increase much superior to the increase of production all over the industry in the same period of time.

ii) The programme of development of the national economy for the next 15 years takes into account this proportion, so that at a 6 times increase of the industrial production, the output of electric power will grow 10 times.

3. Parallel with the ensurance of a just proportion in the development of the various branches of industry, a correct territorial distribution of the forces of production must be concurrently ensured. Rumania's economic development is therefore also based on the achievement of a change in the territorial distribution of the forces of production so that the economic development of all regions should be ensured, with a view to obtaining a general economic impetus.

4. The ensurance of this proportionality in the territorial distribution of production leads to the more rational turning to good account of the natural wealth in all regions of the country, to the raising of the social

productivity of labour and to the ensuring of the economic, social and cultural impetus of the entire country.

5. The planned territorial distribution of production, which takes into account the requirements of the development of the entire national economy and the economic, social and natural conditions of each region has first of all in view the getting nearer of production to the base of raw materials and power resources, as well as to the consumption centres of the respective products. This results in the ever more complete and many-sided utilization of the natural wealth and of the labour force resources, the growth of social labour productivity consequently with the creation of the possibilities of passing to the processing of raw materials through all processing stages, up to the finite product by the liquidation of irrational transport and at great distances. At the same time the territorial distribution of production has in view the planned territorial division of labour between regions and the complex, many-sided development of their economy. The economic specialization of some regions results in the extension of economic cooperation among them, the development of ever more complex relations among the regions.

6. The general development of economy and within it, the large scale reproduction represent a unique process which influences and is influenced in its turn by the territorial distribution of the forces of production.

7.a) The spontaneous territorial distribution of the forces of production leads to the creation of some disproportions in the economic development of the country and at the same time influences in a negative way the development of economy as a whole. Many and sometimes important material and labour resources thus remain unutilized in economy; the social productivity of labour is under the real possibilities of economy; the production expenses and the investments are bigger compared with those objectively necessary.

b) The anarchic character of the territorial distribution of the forces of production is reflected in the parallel existance of some powerfully industrialized centres alongside whole regions, which often have no industrial units, confined to agricultural activity, often rudimentary, with negative consequences on the people's living standard, on the sanitary and cultural situation, etc.

c) The absence of a rational distribution of material production on the territory results in a waste in the processing of raw materials and in the rational use of fuels; it generally leads to uneconomical transport, to the increase in the average distance of transport of raw materials, fuel and finite products; makes difficult the organization of the specialization of industrial enterprises and of the cooperation among them, reduces the economic efficiency of the enterprises, compared with the real possibilities existing in the economy.

d) The spontaneous, irrational location of the industrial units creates difficulties in the organization of some best territorial relations between industry and agriculture, leads in many cases to an irrational use of agricultural areas, to the impossibility of dividing cultures into zones corresponding to favourable pedo-climatic conditions. Naturally that such a location of industry diminishes the economic efficiency of agriculture, compells the producers to cultivate in unfavourable ecological zones the cultures required by the irrationally located industrial processing units.

e) The spontaneous territorial distribution of the forces of production leads to the irrational development of towns, to the creation of overcrowded centres and to large areas lacking possibilities of work. At the same time it causes difficulties also in the field of town planning,

and elevating them from the town planning and sanitary point of view.

8.a) On the eve of World War II, all these negative influences of an irrational territorial distribution of the forces of production could be met in Rumania.

b) Rumania's economy in this period of time was characterized by its backwardness, Industry was poorly developed, the rich natural resources of the country being entirely unsatisfactorily turned to good account. Agriculture, the predominant activity in the country, was characterized by the backward character of the means of work which it utilized, and by the persistance of some powerful feudal remnants.

c). The weak development of industry and the backwardness of agriculture caused the low living standard of the majority of the population.

d) In 1938, the greatest part of the industrial output of Rumania was concentrated in only six industrial districts.

e) The main districts and knots of concentration of Rumania's industry in 1938 were the following:

- in % -

	The specific weight of industrial districts		
	Value of industrial output	Installed power	Number of employees
i) Bucharest - Ploieşti Prahova Valley	33.3	37.0	24.2
ii) Centre of Transylvania (Braşov, Sibiu, Mediaş, Turda, Cluj)	10.6	10.8	9.6
iii) South Western part of the country (Hunedoara, Arad, Timişoara, Reşiţa)	15.3	15.8	16.5
iv) North Western part of the country (Baia Mare, Satul Mare)	2.1	1.5	2.2
v) Bacău - Bunuşi - Piatra Neamţ	2.8	2.8	3.5
vi) Galaţi - Brăila	3.4	3.0	4.0
vii) T O T A L	67.5	71.9	60.0

f) In addition to these districts and knots of industrial concentration, in the rest of the country's territory, industry was represented by small factories and workshops in which manual work prevailed and whose main aim was the production of some consumer goods for local requirements (mills, oil pressing machines, small units of the food industry, small tanneries, lime kilns, quarries, small repaire workshops, etc.). Large regions such as Oltenia, Moldavia, Dobrogea, which possessed considerable and varied natural riches and a great

potential of labour force remained in a state of economic backwardness. The value of the overall production per inhabitant in Moldavia, Dobrogea and Oltenia was approximately 42 per cent of the average of this value for the whole country. The living standard of the population in these regions deprived of industry, of access roads, with a still more backward agriculture than in the rest of the country, was characterized by chronic mal-nutrition of the majority of the population, especially of the rural one, and the social and mal-nutrition diseases such as : tuberculosis, pellagra, etc.played havoc among a great part of the population.

i) According to the data of the 1930 census, out of the total number of industrial enterprises in Oltenia only 14 per cent had motive power, 94 per cent had up to 5 workers and only 6 enterprises grouped in 3 towns - Craiova, Turnu Severin and Tîrgu Jiu had over 200 workers. Out of the 20 administrative districts, in 15 there were no industrial enterprises except some primitive mills.

ii) In the historic province of Moldavia, except for some bigger industrial enterprises, grouped in the localities of Bacău, Buhuşi - Piatra Neamţ, the rest of industry was represented by mills, oil pressing machines and some enterprises of the food and light industry equipped with rudimentary technique. The situation of this historic region was still more aggravated as a consequence of the destructions caused by World War II.

iii) In Dobrogea region, utterly backward from the economic and cultural point of view, industry was represented only by small factories of local importance, agriculture was more backward than in any other part of the country, and over 40 per cent of the population of this region was illiterate.

g) In their turn the districts of industrial concentration did not represent a rational territorial organization of the industrial production. In fact they were a more or less accidental agglomeration of some industrial units unlinked among them from an economic point of view. The industrial enterprises were not specialized, generally they produced a great diversity of products, and the cooperation among them was practically non-existent.

h) In agriculture, the existence of big landlord propriety concurrently with the splitting of peasant agricultural property, the backward agro-technique, the disparity between industrial and agricultural prices, etc. were as many obstacles for the growth of agricultural output and of a scientific division into zones of vegetal and animal production.

i) In large zones with big agricultural resources, Oltenia, Moldavia, Bărăgan, there were no processing enterprises which should turn to account the agricultural produce and through this to stimulate the growth of agricultural production.

k) Pre-war Rumania had no efficacious instrument for remedying the regional desequilibriums in the distribution of the forces of production. The administrative restrictions were confined to influencing only to a certain extent the location of industry in the populated centres, having no effect on its regional repartition. Even within the populated centres, the restrictively administrative methods proved their inefficiency, to a great extent. Noxious industries were situated in the middle of districts; the industrial zones were not delimited in any of the towns of pre-war Rumania.

9. The possibility of fundamentally solving the problems linked with the territorial distribution of the material production, has appeared in Rumania together with the creation of the conditions for the passing to the

planned development of the economy. Considerable funds were invested for the economic development of the regions backward in the past, for the building and commissioning of industrial objectives, for the expansion of the technical material basis of agriculture. At the same time, an important number of social cultural institutions has been built.

10.a) Thus, 120 new industrial enterprises were built and commissioned, and the production capacities of another 60 enterprises were considerably extended in the regions of Moldavia, Oltenia and Dobrogea, between 1948 and 1960.

b) New industrial branches, unknown in the past have been created on the territory of these regions. Hydro and thermo-power stations have been built, as well as steel and machine building works, works and factories of the chemical industry, the food and light industries have been modernized, the natural riches of these regions, oil, timber, etc., are being turned to good account in new industrial constructions endowed with new technique.

c) This enabled the rapid increase of the production of these regions, at a rate superior to the country average rate. Thus, in 1960 the industrial output of Moldavia was 3.7 times and of Oltenia and Dobrogea 4.7 times bigger than in 1950, while all over the country, the production went up 3.6 times in the same period of time.

11. The principles of the rational territorial distribution of the forces of production are being constantly applied in the development of the national economy and as part of it, of the economy of the regions.

12. The main method of achieving them is the planned territorial distribution of investments. In this way, the development at a higher rate of the economy of the formerly backward regions is ensured, as well as the raising of the technical level of production in all regions of the country and the setting up of territorial complexes of production rationally organized and with an increased economic efficiency.

13. As a result of the planned distribution of investments on the territory, an economic, social and cultural impetus of all the country's regions was ensured.

The Dynamics of the Overall Production

in the years 1955-1960

1950 = 100

	1955	1960	Annual average rate of increase 1951 - 1960 percentages
1	2	3	4
a) Rumanian People's Republic	215	369	13.9
b) Argeş Region	221	383	14.4
c) Bacău Region	219	398	14,8

d) Banat Region	185	293	11,4
e) Braşov Region	256	461	16,5
f) Bucharest Region	211	333	13.8
g) Cluj Region	204	316	12.2
h) Crisana Region	260	369	14.0
i) Dobrogea Region	275	491	17.2
j) Galati Region	200	365	13.8
k) Hunedoara Region	190	375	14.2
l) Jassy Region	255	487	18.2
m) Maramureş Region	215	420	15.4
n) Mureş Magyar Autonomous Region	245	454	16.3
o) Oltenia Region	229	436	15.9
p) Ploieşti Region	197	291	11.3
r) Suceava Region	188	260	10.0
s) Town of Bucharest	219	384	14.4
t) Town of Constanţa	226	411	15.2

14. As this table shows, in most of the regions formerly backward from the economic point of view such as: Argeş, Bacău, Crişana, Dobrogea, Jassy, Maramureş, Mureş Magyar Autonomous Region, Oltenia, the industrial production increased in the period 1951 - 1960 at a superior rate compared with the average rate all over the country. The unequal rates are the very consequence of the application of the policy of raising the regions in the past underdeveloped from the economic point of view.

15. As a consequence of the changes in the territorial distribution of industry, new districts, knots and industrial centres have been created, and the old industrial groups have been consolidated and received a more rational content.

16. As a consequence of the industrial development, the urban population increased from 3,713,139 inhabitants in 1948 to 6,030,366 inhabitants on July 1st, 1961. The considerable increase of the urban population brought about the necessity of developing the towns, so that town planning programmes have been worked out for a period of 15 to 20 years for each town.

17.a) The transformations which have occurred in the territorial distribution of the forces of production during the socialist industrialization have turned into life the principles of economic policy in this field. At the same time we must stress that - in concordance with these principles - the transformations are the result of some concrete analyses on the territory regarding the economic efficiency of the location of each objective. In this way the concrete locations of industrial objectives in regions and on localities, made on the basis of technical and economic studies are combined and give life to the requirements of many-sided development of the economies of the regions, playing in their turn a constituent role in the proportional development of the national economy as a whole. Although the problem of the

content of these technical and economic studies of location surpasses the the subject of the present paper, we cannot but mention that in our opinion, the analyses must go from the determination of the locality - taking into account the nature and place of the raw material, the electric power sources, labour force means of communication, market, the requirement of grouping the industrial enterprises depending on the production relations among them etc. - to the location of the enterprise in the town planning programme of the respective locality - this time taking into account the delimitation of the industrial zones, the use in common by several enterprises of some facilities of communal, social and cultural administration.

b) An eloquent example in this respect is the building of the new town of Onești, in the Bacău region, and of the industrial complex in that locality. The industrial complex is based on the superior - chemical - turning to account of oil and oil products. It is made up of a modern oil refinery, the chemical works and a power centre of thermofication. Certain products of the oil refinery are further being processed into synthetic rubber, insecticides, fungicides, herbicides, and other chemical products. The power centre of thermofication supplies the necessary quantity of steam and hot water for the whole complex and for the newly built residential quarters and at the same time it is integrated in the national power system.

18. An important role in the creation of conditions for securing a correct distribution of the forces of production on the territory of the Rumanian People's Republic has been and is played by long term planning. Considering the fact that in general lines, sensible modifications in the territorial proportions cannot be achieved from one year to another, the five-year plans, the six-year economic plan, and the ten-year electrification plan, have placed at larger periods the systematic achievement of a series of measures which, being applied, have permitted the continous improvement of the territorial distribution of the forces of production in the Rumanian People's Republic. Continuing this policy, on the basis of the results obtained so far, the general long term plan (1960 - 1980) marks a new stage during which the territorial distribution of production and of the forces of production will permit an ever more rational content. In conformity with the objectives fixed in the long-term plan, the following criteria of locating the forces of production on the territory have been established in the six-year economic plan (1960-1965):

a) the achievement of the maximum economic efficiency by the use of the favourable economic and natural conditions of each region;

b) the further economic rise of the less developed regions;

c) the creation of an industrial basis in the still weakly industrialized towns;

d) the judicious use of the labour force in all regions of the country.

19. In determining the new industrial constructions on localities, one takes into account the necessity of using the existing spaces and which are more rationaly used from the economic point of view, the requirements of grouping enterprises for the use in common of some installations, administrative, social and cultural constructions, the necessity that the new industrial enterprises, big consumers of thermic energy should be generally built in the neighbourhood of power centres of thermofication, etc. Thus important savings of investments are achieved, as well as the reduction of the production expenses.

20.a) Planning the national economy and permanently following an ade-

quate proportionality in the structure on branches of the industrial production as well as in the territorial distribution, as well as the achievement of other fundamental proportions such as : the proportion between production and consumption, between consumption and accumulation, between the material and the financial means, etc. Rumania has obtained remarkable results in the development of her national economy on a continuously ascending line.

b) Summing up the results obtained, the main indicators of the development of economy show an over 1.6 times increase in the number of employees in 1961 compared with 1950, the growth of the fixed funds by over 1.7 times,of the volume of investments by over 5.2 times,of the social produce by nearly 2.9 times, of the national income by 3 times, of the overall industrial output by 4 times, of the overall agricultural production by 1.8 times. Reflecting the preoccupation for the continuous increase in the material and cultural level of the population, in the same period of time the real wages went up twice, the state's expenditure for social and cultural actions 5 times, the volume of the sale of goods through the socialist trade raised nearly 5 times in 1961 compared with 1949.

c) Illiteracy was liquidated already in the years of the five-year plan 1951 - 1955, the number of pupils in the general culture education increased by over 1,200,000 in the year 1961 - 1962, of the students over three times compared with the school year 1938 - 1939. The generalization of the 7-year compulsory education has been achieved and we have passed on the generalization of 8-year education. The entire education, beginning with the elementary school and up to university education, is free of charge.

d) General death rate decreased from 19.1 per cent in 1938 to 8.7 per cent in 1961, and infantile mortality from 17.9 per cent in the same period to 6.9 per cent.

21. We have mentioned the afore-said results not because they are not known, but in order to underline that we consider that their achievement is also conditioned in its turn by the policy of rational territorial distribution of the forces of production; this permitted the attraction of all regions of the country in a complex economic, social and cultural development during the socialist industrialization, in other words it created pre-requisites so that each region should be able to turn to good account the material and labour resources it possessed, thus making its contribution to the general impetus of the national economy and at the same time profiting by it. The many-sided development of the regions in the process of industrialization increases social labour productivity, raises the level of qualification, creates new occupations, which are reflected in the growth of the living standard. All this seems to us to represent an essential aspect of each policy of industrialization conceived not like a mere increase in the output of some products or others, but as a key factor of the economic, social and cultural progress of the entire people in a country which is developing.

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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item: D.2.2

Romania

PROBLEMS OF STUCTURE AND TERRITORIAL DISTRIBUTION OF INDUSTRY

By Prof. Constantin ICNESCU,
Candidate in Economic Sciences

Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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PROBLEMS OF THE STRUCTURE AND TERRITORIAL DISTRIBUTION OF INDUSTRY

Prof. Constantin Ionescu,
Candidate in Economic Sciences

1. The proportional development of economy requires the establishment of correct proportions between the various branches of the national economy, as well as the establishment of adequate proportions in the many-sided development of each region.

2. As to the first group of proportions, this paper presents some of the main proportions with the aid of which a corresponding structure of industry is ensured:

a) The proportion between the output of the branches producing means of production and the output of consumer goods.

i) In the Rumanian People's Republic this proportion was achieved through the priority increase of the output of the means of production (Group A) compared with the increase of the output of consumer goods (Group B).

ii) Compared with 1938, Group A increased 7.8 times in 1961, and Group B over four times. Within heavy industry, the machine building production increased in 1961 by 13 times as against 1938.

iii) In 1961 the weight of Group A reached 60.9 per cent of the total of industrial output compared with 45.5 per cent in 1938, and that of Group B decreased from 54.5 per cent in 1938 to 39.1 per cent in 1961

b) The proportion between the branches of the extraction industry and the branches of the processing industry. The establishing of correct proportions between these branches ensures the constant development of production and a rhythmical activity in the utilization of the production capacities, as well as of the labour force.

c) The proportion between the output of electric power and the output of the other industrial branches.

i) In order to satisfy the necessities of electric power of the other industrial branches and of the economy, for the introduction of new technique in production by means of electrification , mechanization and automation of production processes, it is necessary that the output of electric power grow at a more rapid rate than the whole industrial production. In 1961 in the Romanian People's Republic the output of electric power went up 12 times as against 1938, an increase much superior to the growth of production all over industry.

3. The rational territorial distribution of the forces of production ensures the economic development of all regions with a view to obtaining a general economic impetus.

4. The planned territorial distribution of production takes into account both the requirements of the development of the whole national economy, and the economic, social and natural conditions of each region. It is achieved first of all through the getting nearer of production to the basis of raw materials and the consumption centres of the respective products. This results in the ever more complete and many-sided use of the natural riches and the labour force, the growth of the productivity of social labour, the liquidation of un-economical transport. At the same time, it deepens specialization within the national economy, parallel with the multilateral development of the economy of all the country's regions.

5. In the pre-war period, 67.5 per cent of the total of industrial production was achieved in six industrial districts, representing small territories where the industrial enterprises were often grouped at random, without an organical link of production among them.

6. In the post-war period, the serious regional disproportions inherited were gradually liquidated and new industrial districts have been created in the process of industrialization. These were created on the basis of certain links of production between enterprises and branches of production, representing a rational territorial organization of industrial production.

7. Consistently applying the policy of economic development of the regions backward in the past and granting priority to the location of new industrial constructions in these regions, industrial production increased in the years 1951-1960 at a rate superior to the country's average in most of these regions. Rationally organized territorial complexes of production took shape and continue to appear on the territory of the Rumanian People's Republic, which in their turn, contribute to the constant development of the national economy, to the increase of the material and cultural living standard of the population.

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Agenda Item: D.4.2

Australia

DRYING OF TREE FRUITS WITH PARTICULAR REFERENCE TO DEHYDRATION AND PRE-TREATMENT WITH SULPHUR DIOXIDE

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Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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DRYING OF TREE FRUITS WITH PARTICULAR REFERENCE TO DEHYDRATION AND PRE-TREATMENT WITH SULPHUR DIOXIDE

by D.McBean, Division of Food Preservation, Commonwealth Scientific and Industrial Research Organization, Sydney, Australia.

1. Tree fruits dried in Australia. Prunes and apricots account for roughly 75% of the production, the remainder, in order of importance, consisting of free-stone peaches, apples, pears, nectarines and figs. Of the total of 5000-7000 tons per annum about 25% is exported. Though small, the industry is prosperous and well organized. Technical problems are investigated through a Dried Fruits Processing committee, the members of which have appropriate qualifications.

2. Sun drying. Most of the fruits, other than apples and plums, are sun dried, at low capital cost, by the grower. The main areas are the irrigations settlements of the Murray, Murrumbidgee and Goulburn rivers in southern Australia, where, during the drying season from December to February, relative humidity is usually low and shade temperatures may reach 100°F or more.

3. Dehydration. A steadily increasing proportion of the tree fruits is now being dehydrated. Nearly all prunes are dehydrated in specially constructed tunnels operated either by individual growers or co-operative bodies of growers. In Tasmania apples are dried in through-draught kilns with slatted wooden floors, heat being supplied to deep beds of sliced fruit mainly by convection from a furnace operated below floor level.

ECONOMICS OF DRYING

4. One of the main reasons for preserving fruit is to reduce wastage, which may be especially great in hot climates. The processed fruit must be in a form capable of easy storage for relatively long periods, and be of a quality acceptable to the consumer.

5. Freezing can only be practised in countries possessing appropriate facilities for processing, storage in bulk, transport, retailing and storage in the home; it will not be considered in any cost comparisons in this paper. Because of its present high cost freeze drying also will be disregarded.

6. Since prunes, nectarines and figs are not usually canned in Australia, the comparison of sun drying, dehydration, and canning which follows is confined to apricots and peaches. White,[2] in studying relative costs in 1950, found the cost of dehydrating

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2 White, L., Dehydration of tree fruits, Quart. Review Ag. Econ., 3, 20 (1950).

fruits to be half that of canning and the cost of sun drying to be about a quarter less than dehydration. An advantage of drying over canning is that practically all the fruit grown can be utilized.

7. The capital cost of establishing even a small cannery is, of course, high, and maintenance and operating costs are considerable. The capital costs of sun drying are low and within the means of the grower who can often use family labour for processing. While large dehydration plants are expensive, many small units suitable for operation by individual growers are relatively inexpensive.

RAW FRUIT FACTORS AFFECTING QUALITY

8. Variety. Fresh fruits with a high solids content usually have good flavour and also give a high yield of dried product. The varieties preferred for drying in Australia are: Prunes - D'Agen, Robe de Sergeant; Apples - Sturmer, Granny Smith; Apricots - Moorpark, Trevatt; Peaches - Elberta, J.H.Hale; Nectarines - Goldmine; Pears - William Bon Chrétien; Figs - Smyrna.

9. Maturity. For successful drying the fruit should be well matured. Apricots, peaches and nectarines picked at eating ripeness have when dried a more pronounced flavour than the canned product, the fruit for which is processed at a less mature stage. Prunes and figs are usually left on the tree until signs of desiccation become apparent. With pears it is practice to pick while still green and to ripen them fully off the tree before drying. Though somewhat wasteful of labour, the selective picking of stone fruits is usually justified by the improved quality of the dried product.

10. Size. To obtain uniform drying it is desirable to select large and small sized fruits from the bulk for separate handling.

11. Skin Type. Although the skin of fruits acts as a barrier to the uptake of preservatives before, and to the evaporation of water during, drying, only with apples is the skin invariably removed prior to drying .

PREPARATION FOR DRYING

12. Picking. Fruit, especially apricots, peaches, nectarines and pears, must not be dropped into picking containers but be handled carefully in that and all other operations, since being fully ripe, it will bruise easily. Bruising causes a discoloration, due to enzymic action, which once formed cannot be removed from the injured tissue.

13. Peeling. Because of their thick and waxy skin, apples should be peeled prior to drying. Machines to peel and core apples are available, ranging in size from small hand operated types to those of large capacity operated mechanically. Apricots, nectarines, prunes and figs are not usually peeled, but prunes are sometimes dipped into, or sprayed with, a weak solution of alkali which removes some of the waxy constituents and produces small cracks in the skins, so facilitating drying. Although not normally followed in commercial practice, the skinning of peaches and pears prior to drying has been shown by experiments[3] to result in an improved product. When fully

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[3] McBean, D., and Shipton, J., The dehydration of apricots and peaches, Commonwealth Scientific and Industrial Research Organization, Food Pres. Quart., 10, 59 (1950).

ripe these fruits can be peeled very readily by immersion in boiling water, or by steaming, for 30-45 seconds.

14. Sub-Division. Drying times are dependent upon the size of fruit or of pieces. In Australia, except for prunes, it is usual to dry stone fruits in halves after removing the pit. With prunes and figs, which are dried whole, the drying is slow. Pears are halved and the calyx is removed. Apples, after peeling and coring, are sliced into rings about 5-6 mm thick. Freestone peaches have been dehydrated experimentally as peeled slices but while the product is of excellent quality the slices are fragile when dry and stick to the trays.

15. Tray-type and Loading Rate. Since metal tends to corrode easily, trays used for fruit drying are made usually of wood, soft being preferred to hard woods which stain the product. Cleats are used to allow the trays to be stacked on 3 inch centres. The base of the tray on which the fruit is placed may be of slatted or continuous construction, the former allowing slightly faster drying. The floors of apple drying kilns are made of wooden slats. Loading rates range usually from 2 lb per square foot for apricots up to 4 lb per square foot for pears.

16. Blanching. Blanching of fruit in steam or hot water prior to dehydration has been recommended by Perry et al[4] to remove air from its tissues and to give a more translucent product. Australian experience[3] has not shown blanching to be advantageous and unblanched fruit has given produce of good quality and appearance, especially when reconstituted and cooked.

TREATMENT WITH SULPHUR DIOXIDE

17. Use of sulphur dioxide is desirable with all fruits except the naturally dark coloured prunes. Sulphur dioxide retards the browning reaction between amino acids and reducing sugars. The mechanism by which this occurs is not fully understood and is being investigated. The use of sulphur dioxide, permitted in most countries of the world with dried fruits, is limited in Australia to 3,000 parts per million. Since many factors affect the initial uptake of sulphur dioxide as well as its retention during drying, it is difficult, in commercial practice, to control its level in the dried fruit.

18. Methods.
(a) When drying vegetables, it is usual to dip the prepared pieces momentarily in a solution of sodium sulphite. If this method is adopted with fruits, using bisulphite or metabisulphite whose pH is nearer to that of fruits, an objectionable off-flavour develops in the dried product.
(b) Liquid sulphur dioxide may be used but its cost is considerably greater and may be prohibitive. Nowadays in Australia, the common practice, cheap and easy, is to place a plastic tent over a stack of loaded trays and to diffuse sulphur dioxide through them by burning sulphur in a small pit connected to the enclosure by an underground channel. Small holes in the top of the tent ensure even diffusion of the gas. More permanent structures of brick or concrete are little used.

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[4] Perry, R.L., Mrak, E.M., Phaff, H.J., Marsh, G.L., and Fisher, C.D., Fruit dehydration 1. Principles and equipment, Cal. Ag. Exp. St. Bull. No.698 (1946).

FACTORS AFFECTING UPTAKE OF SULPHUR DIOXIDE

19. Raw Fruit Characteristics. The cut surfaces of fruits of different types absorb sulphur dioxide at a similar rate, which is usually 6-7 times greater than through the skin. The fact that over-ripe fruit absorbs slightly less than ripe fruit is due probably to ripeness causing leakage of liquid into the intercellular spaces. This may also explain why blanched tissue tends to absorb less sulphur dioxide than unblanched. Small fruits absorb more than large ones because of their greater surface area to weight ratio.

20. Gas Concentration. The concentration of sulphur dioxide to which the fruit is exposed is one of the most important factors governing its absorption. In tests made during commercial sulphuring the concentration of gas was found to be in the 1-2% range. The rate of gas production can be controlled to some extent by varying the air supply to the molten burning sulphur. This may prove of special consequence on windy days when the sulphur tends to burn more quickly.

21. Time of Exposure. This variable has a marked influence on the amount of gas absorbed. Absorption, at first rapid, approaches equilibrium gradually, depending upon the concentration of sulphur dioxide in the surrounding atmosphere. The fruit shows a steep gradient in its sulphur dioxide content which decreases from its surface inwards. In Australia a sulphuring time of 5-6 hours which is recommended for apricots to be sun dried, is reduced to 3 hours when the fruit is to be dehydrated. For sun drying pears, an exposure of up to 18 hours is needed.

22. Temperature. Although the absorption by the fruit of sulphur dioxide decreases with increasing temperature, the effect is too small to be of practical significance.

23. Desorption.
(a) Since fruit begins to lose sulphur dioxide as soon as it is removed from the sulphuring enclosure, it should be placed to dry in the sun, or in the dehydrator, as quickly as possible.
(b) Factors affecting the drying rate of fruits will influence markedly the retention of the preservative and it is surmised that it is the sealing of fruit surfaces which limits desorption.

24. Rate of Drying. Low ambient temperatures or high relative humidities during sun drying decrease the rate of drying, so resulting in a poor retention of sulphur dioxide which, under adverse conditions, may be as low as 2-3% . If this occurs the fruit may be re-sulphured within 24 hours of first being put out to dry.

SUN DRYING

25. Since the efficacy of sun drying will depend on climatic conditions, careful consideration is needed of meteorological data relating to the time of crop maturity. A maximum dry bulb temperature of from 80° - 100°F with a relative humidity of below 50% will allow a satisfactory rate of drying.

26. Under good climatic conditions drying times may vary from 2-3 days for apricots, up to 14 days for pears and large peaches. Where a long drying period is involved the fruit trays should be stacked, for much of the latter part, so as to minimize the bleaching of dried surfaces.

DEHYDRATION

27. Dehydration has several advantages. Fruit can be dried irrespective of climatic conditions and the product is cleaner than in the case of sun drying where dust and insects may collect on the sticky surfaces of the drying fruit. The times taken for dehydration are much shorter than for sun drying, being 8-12 hours for apricots, 12-18 hours for peaches, 16-24 hours for apples, and 20-30 hours for pears, prunes and figs.

28. Types of Dehydration. Perry et al[4] have listed the various types of dehydrators suitable for drying fruit. In Australia most of the small and medium sized dryers are of the counter flow tunnel type in which the trolleys of fruit progress in a direction opposite to the air flow so that they enter the cool end and finish at the hot end of the tunnel.

29. Air Velocity and Recirculation.
(a) Air speed in the type of dryer described should range from 500 to 800 linear feet per minute in an empty tunnel. This velocity suffices to provide the heat needed to evaporate moisture from the surfaces of the fruit and also to remove moisture vapour. The air velocity should be kept as uniform as possible to ensure even temperature and drying within the tunnel.
(b) Observation of the dry and wet bulb thermometers at the cool end of the tunnel should determine how much of the air should be recirculated for maximum heat efficiency. The control vents should be adjusted so that the relative humidity at the cool end of the tunnel is maintained at between 50 and 60%.

30. Temperature of Drying. As the fruit enters the cool, humid end of a counter flow tunnel its temperature approaches that of the wet bulb thermometer. As drying proceeds evaporation decreases and by the time the fruit reaches the hot end its temperature approximates that shown by the dry bulb thermometer. The maximum temperature reached should be between 140° and 160°F. It is important that no heat damage should occur to the product during the final stages of drying.

31. Source of Heat. The type of fuel used usually depends on its cost and, as a consequence, on geographical situation. Wood-fired units used initially in Australia have been replaced largely by oil-burners. With oil, a thermostatic control of the inlet temperature enables precise operation, but with wood fuel wide fluctuations are unavoidable.

STORAGE OF DRIED FRUITS

32. Moisture Content. Fruits should be dried to a moisture content inhibiting microbial growth which in practice is usually between 15 and 20% or corresponding to equilibrium relative humidites of 60 to 70%. If the relative humidity is below that range the dried fruit, if kept under open storage, will lose further weight. Where the relative humidity is high for a long period, say averaging 80%, there is a distinct danger of the dried fruit absorbing sufficient moisture to allow microbial spoilage.

33. Packaging. Most dried fruit in Australia is packed initially in paper lined wooden cases holding about 40 lb of fruit. Insect infestation in cased fruit is controlled by the addition of ethyl formate which volatilizes without leaving a residue. The trend in Australia is towards retailing dried fruit, particularly apricots and apples,

in small plastic packs containing about 23% moisture. Fruit from these "moist" packs is easier to reconstitute and cook and when eaten raw is more palatable. The keeping quality of moist packed prunes can be ensured by hot filling or, if the film packaging permits, by heat treatment after sealing.

34. Sulphur Dioxide Level. In the hotter parts of Australia a level of 3000 p.p.m. of sulphur dioxide is necessary in dried fruits for a storage life of up to 12 months.

35. Effect of Temperature. The rate of browning increases as does temperature. For prolonged storage under really hot conditions, holding at temperatures below 68°F is desirable.

USAGE OF DRIED FRUITS

36. Further Processing. Dried fruit is convenient for use in processed foods such as jams, chutneys and various confectionery products as it can be stored at ambient temperature until it is required.

37. Reconstitution for Cooking. Most of the fruit dried in Australia is consumed after cooking. Soaking prior to cooking is necessary and, since individual pieces are fairly large, a soaking period of up to 24 hours may be necessary.

38. Cooking. Following soaking, the fruit should be cooked for 10 to 20 minutes. Much of the sulphur dioxide is driven off during the cooking but about 50-100 p.p.m. remains, detectable only by the few consumers sensitive to such low concentrations.

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SUMMARY

Agenda Item: D.4.2

Australia

DRYING OF TREE FRUITS WITH PARTICULAR REFERENCE TO DEHYDRATION AND PRE-TREATMENT WITH SULPHUR DIOXIDE

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Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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DRYING OF TREE FRUITS WITH PARTICULAR REFERENCE TO DEHYDRATION AND PRE-TREATMENT WITH SULPHUR DIOXIDE

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The Australian dried tree fruit industry, its production of 5000-7000 tons but a small part of the total world production, consists mainly of small producers, to whom technical assistance is given through a Dried Fruits Processing Committee. The principal centres of production are in southern regions where relative humidity is low and temperature high during the drying season.

Prunes and apricots constitute 75% of the production, followed in order of importance by peaches, apples, pears, nectarines and figs. Prunes are the only fruit grown specifically for drying.

All prunes and apples are dehydrated by the growers, either individually or in co-operatives, of the other fruits, though dehydration may be extending, a very high proportion is sun dried, by the growers themselves, at low cost.

In Australia the cost of dehydration is about half that of canning, while sun drying costs about 25% less than dehydration. Moreover the capital costs of sun drying and dehydration, compared with those of evan a small cannery, are low.

By drying, the washage of fresh fruits is reduced. The product is stable, inexpensive to store and transport and acceptable to many consumers.

The paper goes on to consider factors that affect the quality to be desired in new fruit that is to be dried, and certain procedures to be followed to ensure that fruit is in good condition for drying and kept in good condition during drying.

To prevent 'browning' all fruits except prunes have to be treated with sulphur dioxide. Modes of treatment are considered and one, much used in Australia, which is not only effective but simple and cheap, is suggested.

Expositions of the two methods of drying, by sun and by dehydration are follwed by advices concerning storage and packaging and the paper concludes with some remarks on the usages of dried fruits.

Before establishing fruit drying in a new area it is advisable to study meteorological data and determine whether sun drying, dehydration, or possibly a combination of them, should be adopted. Local varieties of fruit may be tested to see if, with adequate information and guidance, they can be processed into a commodity of good quality for which there is likely to be a sufficient home or export market.

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